"Essays in Political Economy and Fiscal Policy"

Dissertation
for the Faculty of Economics, Business Administration and Information Technology of the University of Zurich

to achieve the title of
Doctor of Philosophy
in Economics

presented by

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from Pforzheim, Germany

approved in October 2010 at the request of

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The Faculty of Economics, Business Administration and Information Technology of the University of Zurich hereby authorises the printing of this Doctoral Thesis, without thereby giving any opinion on the views contained therein.

Zurich, 27 October 2010

Chairman of the Doctoral Committee: Prof. Dr. Dieter Pfaff

Acknowledgments

This dissertation, and I as a person, have greatly benefited from lively, inspiring discussions with friends, colleagues and teachers, not only on the topics covered in this thesis, but also on other fields of economics, on being an economist and on life in general.

Especially, I would like to thank Allan Drazen for raising my interest in Political Economy; Bruno S. Frey, Gérard Hertig and Alois Stutzer for their excellent seminars; Axel Dreher for great support and extrinsic motivation; Christian Conrad, Stefan Hupfeld, Michael Lamla, Andrea Lassmann, Sarah Lein and Nick Netzer for being great friends and colleagues during my time as a PhD student and since day one of my studies of economics; Arye Hillman and Pierre-Guillaume Méon for discussions especially on life beyond economics; Thomas Bolli, Justina Fischer, Christoph Schaltegger and David Stadelmann for great research cooperation, and Jan-Egbert Sturm, Bruno S. Frey and Gérard Hertig for being my supervisor and committee members.

My deepest gratitude belongs to my wife Rebecca, for her great support, patience, humor and our beloved daughter.

Für Marlene.

This dissertation consists of the five research papers listed below.

Globalization and Protection of Employment
co-authored by Justina A.V. Fischer.
published as KOF Working Paper 238, KOF Swiss Economic Institute, ETH Zurich.

The Impact of Political Leaders' Profession and Education on Reforms
co-authored by Axel Dreher, Michael J. Lamla and Sarah M. Lein
published in Journal of Comparative Economics 37(1): 169-193 (2009).

The Impact of Political Leaders' Profession and Education on Public Finance
co-authored by Heiner F. Mikosch
this paper has not been published yet.

Tax Competition and Income Sorting: Evidence from the Zurich Metropolitan Area
co-authored by Christoph A. Schaltegger and Jan-Egbert Sturm
published as KOF Working Paper 240, KOF Swiss Economic Institute, ETH Zurich.

Do competitively acquired funds induce universities to increase productivity?
co-authored by Thomas Bolli
published in Research Policy, forthcoming.

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Chapter 1

Introduction and Summary

Introduction and Summary

> Economists must not only know their economic models,
> but also understand politics, interests, conflicts, passions
> – the essence of collective life. For a brief period of time you
> could make changes by decree; but to let them persist,
> you have to build coalitions and bring people around.
> You have to be a politician.
> *Alejandro Foxley, former Chilean Minister of Finance*
> *(quoted in Drazen, 2000)*

1.1 General Remarks

'Political Economy' is not a novel concept. To the contrary, for centuries researchers have been studying the effects of politics on economic outcomes. What today is known as 'economics' has been known in the days of Adam Smith as 'political economy'. Still today, the French word for 'economics' is 'économie politique'.

Economics and politics have hence not been seen as distinct fields in the early days of the economic literature, or at least, economics and politics were not perceived as separable from each other. Beginning with the introduction of formal models and rigorous mathematical analysis, this view changed. Neoclassical economists focused their work on the optimizing behavior of firms and consumers, not only ignoring any political factors, but actively assuming them away by the introduction of such concepts as the omniscient and benevolent social planner.

The interest in the interplay between economics and politics began to rise again in the 1960s and 1970s following the seminal contributions of Arrow (1951), Buchanan and Tullock (1962) and Kydland and Prescott (1977). These contributions laid the foundations for three strands of the literature[1] that have been increasingly integrated since the mid 1980s, which has lead to an over-

[1] See e.g. Persson and Tabellini (2002), on which the presentation of the three fields in the following draws.

whelming flood of new studies in the field that is nowadays known as the 'New Political Economy'.

The work of Kydland and Prescott (1977) founded the stream of macroeconomic policy analysis and is based on the contributions of Lucas, who studied economic policy outcomes as the consequence of different policy rules. Kydland and Prescott (1977) however argued that not all of these policy rules are implementable or sustainable, as they lack credibility. This lack of credibility arises if the policymaker has an incentive to change the rule after its implementation, i.e., if the optimality of the policy from the viewpoint of the policymaker is time dependent. Hence, the concept of Kydland and Prescott (1977) has become known as 'time-consistency'. As rational agents base their behavior on their expectations of the future, including expectations about the future behavior of policymakers, time-inconsistent policy rules will lead to adverse economic outcomes. This insight has led to a large body of political economic literature analyzing macroeconomic phenomena, such as inflation, unemployment and the business cycle (see e.g. Barro and Gordon, 1983a,b).

The works of Buchanan and Tullock (1962), and also Olson (1965), have pioneered 'Public Choice' theory. The literature in this field focuses on the principal-agent relations between citizens and government, providing analyses of a multitude of political fields, such as trade policy, regulation of markets and fiscal policy. Specifically, it studies the effects of rent-seeking, both by politicians and interest groups, the effects of imperfect information about policy programs on the side of the electorate, and the effects of different constitutional setups on economic and political outcomes. Thereby, however, oftentimes less strict assumptions about the rationality of the agents are made, as is the case in the model of politically induced business cycles as presented by Nordhaus (1975), where voters are repeatedly fooled by politicians.

'Rational Choice' is the field of analysis that has emerged from the political science literature. Since the contribution of Arrow (1951), the focus in political science has shifted away from the formulation of a general theory of collective choice, and has concentrated on the analysis of collective choice within the framework of different political institutions. The institutions analyzed in this branch of the literature include, among others, voting procedures and legisla-

tive processes. Thereby, not economic outcomes were in the center of interest, but the analysis of political institutions using the rationality-assuming methods known in economics.

Hence, by combining these three strands of the literature, the 'New Political Economy' is not a mere revival of what was known as political economy two hundred years ago. The common denominator is still the analysis of the effects of politics on economic outcomes. The contribution of the new political economy is rather the transfer of modern methods of economic analysis, including the rational choice approach, to the analysis of political behavior of politicians, voters and interest groups and economic outcomes subject to the incentives and constraints set by political institutions, as defined by Alt and Shepsle (1990, p.2).

This doctoral thesis adds to this literature in several aspects. Chapter 2 gives an analysis of labor market regulation, specifically the protection of workers from being dismissed, and its interplay with globalization, looking not only at its economic dimension, but also at the effects of international political institutions and the internationalization of social values. In Chapters 3 and 4, we argue that personal values and attitudes of politicians are an additional explanation for differences in political behavior and the resulting economic outcomes and provide an analysis of the effects of the education and profession of policymakers on reform activity and fiscal policy. Chapter 5 demonstrates how the strategic interaction between multiple jurisdictions influences the choice of residence of different groups of the society, while Chapter 6 analyses the effect of the institutions for the promotion of research on the behavior of research institutions. The next section gives an outline of the thesis.

1.2 Outline of the Thesis

This thesis is composed of five main chapters, each studying a separate topic from a political economy perspective.

In Chapter 2, we study the effect of globalization, measured by its economic, political and social dimensions, on regulation in the labor market, specifically on the protection of workers against being dismissed or being exploited by the

use of short-term contracts. From a political point of view, this is an interesting topic, as unionists and politicians frequently claim that globalization lowers employment protection. The economic rationale behind this argument is that labor standards, which in addition to legislation against unjustified and mass dismissals also comprise workers' right to form unions and regulations of the maximum number of working hours, impose additional production costs and threaten the international competitiveness of firms, which in turn lobby for a decrease in employment protection. Consequently, international competition among producers in countries with heterogeneous labor standards may trigger a race-to-the-bottom. To prevent such development, governments attempt to harmonize international legislation through international organizations, such as the World Trade Organization (WTO) and the International Labour Organization (ILO). These institutions try to set binding minimum labor standards, but often do not have the necessary legal means to enforce them. This leaves room for individual gains if policymakers deviate from the common policy, which then results in the same (undesired) equilibrium as in the situation without international coordination, or in a situation where the effects of economic globalization are attenuated at best. Similar arguments hold for the international spreading of ideas and values. If there is an international consensus on the need for a minimum level of labor protection, policymakers will have the support from the electorate to ensure such a minimum standard.

To gauge these possibly counteracting effects of globalization and its subcomponents on labor protection, in Chapter 2 we estimate panel regressions for 28 OECD countries from 1985 to 2003, differentiating between three dimensions of globalization and protection in two segments of the labor market. With this chapter we are among the first to test the hypothesis that globalization leads to such a race-to-the-bottom process that weakens workers' employment protection. In our estimations, we find a substantial influence of globalization on employment protection. A novelty is that this influence is found to differ both across the dimensions of globalization (economic, political, and social) as well as across the different labor market sectors (short-term contract and regular-contract workers). While the economic and political dimensions of globalization are shown to loosen protection of the regularly employed, we find that

political and social globalization tighten the laws regulating the possibility of offering or extending limited- or short-term contracts. We argue that these differential effects by dimension of globalization and labor market sector are well in line with recent political economy models of international trade, which have three characteristics: lobbying of agents (workers, producers), credibility of politicians necessary to fulfill their transmission channel functions with respect to the agents' opposing preferences, and taking into account the relative economic importance of the two labor market sectors. Specifically, we argue that stricter protection of the economically less important group of short-term workers may serve as symbolic political act by vote-maximizing politicians intending to 'buy' workers' acceptance of labor market liberalization for the regularly employed. As further results, we are able to show that globalization amplifies the effects of macroeconomic conditions on labor protection. Finally, Chapter 2 shows that political ideology does not matter only per se for labor market regulation, but that politicians of different ideology react differently to the downward pressure on labor protection through globalization. Specifically, we show that left-wing governments attempt to counteract the liberalization pressure exerted by economic globalization, while the negative effect of right wing governments on labor protection is aggravated by globalization.

Ideology, or personal values, plays also the dominant role in the analyses of Chapters 3 and 4. However, we proxy personal values of politicians not only with their political leaning, but introduce the education and profession of politicians as a new means to explain economic policy outcomes. In doing so, we add to the recent literature connecting personal traits of politicians with actual policy outcomes. So far, the literature has found that, for economic growth, the person of the head of government matters per se, as an unexpected change in the leadership of a country due to the death of the incumbent can trigger substantial changes in the variance of this variable. Further studies examine the effect of the reservation of parliament seats for women and socially disadvantaged groups in India or the influence of daughters on US congressmen, all finding effects of peer-group oriented policies. Significant effects are also found in papers studying the effect of personal career ambitions, education and profession on the performance of central bankers. Another strand of the literature looks at the

effect of different fields of study of current and former university students on their social behavior, finding that especially economists are significantly more selfish than students of other fields.

In Chapter 3, we compile and present a novel data set covering the education and profession of more than 500 political leaders from 73 countries over the period 1970-2005 and analyze whether the educational and professional background of a head of government matters for the implementation of market-liberalizing reforms. Our results show that reforms are more likely during the tenure of former entrepreneurs. Political ideology, in combination with profession, is also shown to have a significant effect, as entrepreneurs belonging to a left-wing party are more successful in inducing reforms than a member of a right-wing party with the same previous profession. Former professional scientists also foster reforms, the more so, the longer they stay in office.

Chapter 4 extends the analysis to fiscal policy. So far, the political economy literature can only claim partial success in the analysis of the determinants of public deficits and public debt, as all politico-economic approaches taken together can only explain about fifty percent of international differences in government debt, leaving room for further research. The past research has first focused on politicians and their opportunistic or partisan motives, has then moved on to the analysis of distributional conflicts between politicians, voters and interest groups and has recently concentrated on the institutions of the budgetary process.

In Chapter 4, we take a step further by going back to the analysis of policymakers' motives. So far, the existence of different preferences or values of policymakers has only been assumed in the literature, but no explanation of their origins has been given. As in Chapter 3, we argue that one source of different preferences, and hence different policy outcomes, lies in the different socialization of policymakers, which is reflected by their education and profession. Consequently, we test whether the education and profession of politicians is a determinant of fiscal policy using panel data for 22 OECD countries over the period 1970-2004. The results show that education and profession indeed matter for fiscal policymaking. Former civil servants and military officers generate higher deficits than the other groups of politicians, the policies of professional

politicians differ depending on their education, partisanship depends on the former profession and peer group of the politician, and institutional sclerosis reduces the positive influence of economists on the budget surplus.

The subsequent Chapter 5 also studies a topic in fiscal policy, this time at the local level. Furthermore, we do not analyze the determinants of fiscal policy in this chapter, but evaluate the effect of the strategic interaction in fiscal policymaking between local governments on the choice of location of individuals. Specifically, we ask whether income taxes, which differ between Swiss communities, influence the income distribution in the communities of the Swiss canton of Zurich in the way predicted by Tiebout (1956). In Chapter 5, we are the first to study income sorting using panel data for a small and culturally homogeneous region. Therefore, unlike the previous literature, we are not only able to make use of cross-sectional variation, but can also take account of variations in tax rates and income shares over time. We also include the house price channel, which is often ignored in the literature, into our analysis. Furthermore, by using data from one single canton we avoid having to take account of factors determining the decision to move that are hard to measure or even not measurable, such as differences in mentality, attachment to the local community, family ties, or differences in the school system. Finally, we control for spatial interdependence between the different communities.

Using our data set covering the years 1991-2003, 14 different income classes and all 171 communities in the canton of Zurich, we provide evidence that high income earners are more likely to reside in low tax communities, especially if neighboring communities in the same district have higher taxes. The opposite holds for low-income earners: they are more likely to settle in high tax communities. In addition, we find that land prices exert a significant effect on the choice of residence of different income groups, and hence on the income distribution. The fact that both land prices and tax rates exert a significant effect on the choice of residence leads us to the conclusion that the capitalization of tax rates in house prices is imperfect.

The final main chapter of this thesis, Chapter 6, also deals with the incentives set by fiscal policy. In this chapter, we study the effect of public and private spending on research institutions. Specifically, we examine the effect of public

and private third-party funding on the productivity of public research institutions in Switzerland. We do so, as the measurement and evaluation of university productivity has become increasingly important during the past years, both in the academic discussion and in research policy. Third party funding is frequently used as a proxy for research output and quality in both fields. However, while the relevance of third-party funding has increased both in the political sphere and the academic literature, there are few articles analyzing the impact of different sources of third-party funding on research productivity. Furthermore, both the theoretical and empirical findings are ambiguous, indicating that further research in this area is required to allow policymakers to make evidence-based decisions.

For our analysis in Chapter 6, we use data from a survey by KOF Swiss Economic Institute, conducted among Swiss research institutions in 2005. The survey covers all types of public research institutions in Switzerland: cantonal universities, federal institutes of technology, universities of applied sciences and federal research institutions. We add to the existing literature by including a measure for technology transfer into our analysis. By distinguishing between public and private third-party funding, our approach allows us to identify the differences between the two funding sources in the innovation stages of basic research and applied research, measured by scientific publications and technology transfer intensity. Using a simultaneous equations (three stage least squares) approach, we account for the possible endogeneity between the different outputs. Furthermore, using a simultaneous equations approach enables us to estimate the effect of different funding sources on the output categories separately. This is also a novel addition to the literature on research productivity, which has so far either ignored simultaneity by focusing on single outputs, or has used aggregate measures of output. In our regressions, we find significant effects of both public and private third party funding on research productivity. The effects are found to differ between the different output categories. Productivity in teaching is found not to be related to differences in public or private third party funding. Both public and private funds are found to increase productivity in basic research, as measured by the number of scientific publications. The findings for teaching and basic research are robust to the inclusion of

technology transfer, which proxies applied research output, into the estimated system. For the productivity in this field, we find a positive effect of private funds, and no significant effect of public funding. Our results also reveal that productivity of each output type differs across institution types and scientific fields. The results are robust to a battery of robustness checks, and remain also unaltered once we control for the possible endogeneity between the ability to acquire third-party funding and productivity.

1.3 Further Research

With our analysis of the interplay between the three dimensions of globalization and employment protection legislation, we make an additional step into the direction of a more detailed analysis of the effects of an increasing international integration on labor conditions. Further research might be extended to other domains, such as child labor and safety in the workplace.

The extension of the analysis of the effect of the education and profession to other fields of policy is also an obvious path for further research. Promising areas of study could be the size and scope of government, and the composition of the public budget. Furthermore, the data set could be extended to the entire cabinet.

An interesting way to go in the field of income sorting and tax competition would be to link this literature to the literature on the adverse effects of income sorting in education economics. There, it is argued that the opportunities of an individual are highly correlated with his or her neighborhood and social background. Hence, if tax competition induces strong sorting by income, it might also contribute to social problems such as persistent inequality and poverty traps.

Finally, further research in the domain of university funding might delve deeper into the effects of different procedures of funds distribution on research productivity, and might analyze the impact of more accurately specified funding sources on the behavior of researchers.

Chapter 2

Globalization and Protection of Employment

Globalization and Protection of Employment[1]

2.1 Introduction

The question of a harmonization of labor standards is on the agenda of nearly all intergovernmental meetings on international trade, be it in the framework of the European Union (EU), the North American Free Trade Agreement (NAFTA), or the World Trade Organization (WTO). Such labor standards comprise workers' right to form unions, fix maximum number of working hours and protect against unjustified and mass dismissals – from a producer's point of view thereby imposing additional production costs and threatening the international competitiveness of their firms. Consequently, international competition among producers in countries with heterogeneous labor standards may trigger a race-to-the-bottom (Sinn, 2001; OECD, 2000; ILO, 2009). To prevent such development some international organizations, for example the WTO and the International Labour Organization (ILO), try to set minimum labor standards, but often do not have the necessary legal means to enforce them (see Krueger, 1996, on the missing enforcement of compulsory schooling laws to prevent child labor). As described in ILO (2009), the means of international enforcement are weak as they include only instruments of 'social dialogues' and 'technical assistance'.[2] In response, domestic politicians mainly from the political left typically demand a legally binding harmonization of labor standards above the minimum level, or argue even against further expansion of free trade.

With this chapter we are among the first to test the claim that globalization leads to such a race-to-the-bottom process that weakens workers' employment protection. Using a panel on measures of globalization and employment pro-

[1] This chapter is based on Fischer and Somogyi (2009).

[2] The ILO Declaration on Fundamental Principles and Rights at Work, adopted in 1998 and laid down in several separate conventions (no. 29, 87, 98, 105, 111, 138), covers only so-called core labor standards, in particular "1) freedom from forced labor in the form of compulsory labor and slavery, (2) the abolition of exploitative forms of child labor that put the safety and health of children at significant risk, (3) equal opportunity in employment, and (4) fundamental union rights like freedom of association and collective bargaining" (Busse, 2004, p.212). Thus, certain aspects of protection of employment are not covered. The ILO labor standards are summarized and introduced in ILO (2009).

tection of 28 member countries of the Organisation for Economic Co-operation and Development (OECD) from 1985 to 2003, we find a substantial influence of globalization on employment protection. A novelty is that this influence is found to differ both across the dimensions of globalization (economic, political, and social) as well as across the different labor market sectors (short-term contract and regular-contract workers). While the economic, political and social dimensions of globalization are shown to loosen protection of the regularly employed, we find that political and social globalization tighten the laws regulating the possibility of offering/extending limited- or short-term contracts. We argue that these differential effects by dimension of globalization and labor market sector are well in line with recent political economy models of international trade, which have three characteristics: lobbying of agents (workers, producers), credibility of politicians necessary to fulfill their transmission channel functions with respect to the agents' opposing preferences, and taking into account the relative economic importance of the two labor market sectors.

The remainder of the chapter is organized as follows: the next two sections describe previous mostly empirical literature, illustrates more thoroughly the research gap to be filled, and derives testable hypotheses that guide our empirical analysis. Section 2.4 describes the data on globalization, employment protection and the controlling variables that form part of the empirical model, which is also introduced in Section 2.4. Section 2.5 presents the empirical results for the direct effects of economic, political and social globalization on workers' employment conditions, while Section 2.6 investigates how globalization may amplify the pressure exerted by domestic economic or political conditions. The findings in this chapter are finally discussed and concluded in Section 2.7.

2.2 Literature Review

Most theoretical models of international trade such as the ones by Bhagwati and Srinivasan (1995) and Stern (2003) predict that globalization lowers labor standards, due to a race-to-the-bottom in regulatory competition along the lines of

the seminal Tiebout (1956) model.[3] As already argued in the review by Brown (2000), free trade prevents passing the additional production costs of complying with certain labor standards on to the consumer, who has the possibility to substitute with cheaper imported goods. Therefore, in open economies these additional production costs have to be borne by the firms and their workers alone. The race to the bottom of labor standards is then the outcome of a prisoners' dilemma game, in which the firm/country that deviates first reaps excessive profits/welfare gains from trade. However, trade theorists emphasize that such race to the bottom does not occur among small open economies – labor standards are then not able to spill-over across borders, – but well in the case of large countries or when small countries have formed large trading blocks that strategically interact. In the case of the economically advanced OECD countries, the latter arguments apply.

In contrast to the theoretical models that predict a negative relation between globalization and labor standards, existing empirical evidence is rather scarce and provides mixed results.[4]

Most of the early empirical studies employ only flows of foreign direct investment (FDI) as measure of economic globalization and focus only on core labor standards set by the ILO (see footnote 1), but not on general employment protection. Moreover, the research question is rather how costs of labor and social stability affect location decisions of investors, not how globalization affects the level of labor standards in a country (for an example, see Kucera (2002), and literature cited therein).

One of the first contributions to empirically relate trade openness, replacing FDI of the previous analyses, with some specific core labor standards appear to be Shelburne (2001), and Cigno et al. (2002): both papers find independently from each other that trade openness reduces the prevalence of child labor – abolition of child exploitation is one of the core ILO labor conventions.

[3]Theoretical arguments may well go into the opposite direction, predicting the impact of labor standards on trade volume, see also Krueger (1996).

[4]Early empirical analyses on the effect of international trade on relative wages (skilled vs. unskilled) in the USA, wage inequality worldwide, wage stability for production workers, trade and freedom-of-association-rights, trade and rights to non-discrimination are described in Brown (2000).

Busse (2004) uses this research as a starting point and extends it to incorporate also the remaining core labor standards covered by the ILO conventions. He finds in a fixed effects panel analysis of 71 developing countries from 1970 to 2000 that more openness to trade appears to lead to increased gender discrimination in the labor market, growing prevalence of child labor, and less unions rights (freedom of association). Providing the rationale for the deterioration of certain labor standards as national economies become more globalized, Busse and Spielmann (2006) show in a panel fixed effects analysis of a world sample (1975-2000) that gender inequality in wages creates a comparative advantage in the production of labor-intensive commodities. While the empirical analysis by Busse (2004) is an important contribution to the literature on the impact of trade on core labor standard, it does not cover the effects on general employment protection.

Turning to the question of union rights which comes closest to measuring general 'employment protection' of adult workers against e.g. mass dismissals and exploitative work contracts, Dreher and Gaston (2005) find in a cross-section time-series of 17 OECD countries from 1980 to 1999 (with country fixed effects) that globalization adversely affects density and attractiveness of unions – as a consequence of, as they argue, their lower (relative) bargaining power. Testing several dimensions of globalization, one of the few empirical contributions making such a distinction, they find that this development is driven by the social dimension of globalization, which includes worldwide communication, exchange of ideas, and convergence of local cultures. In contrast, the economic and political dimensions do not appear to exert any impact. This is a noteworthy result given that most arguments that link globalization with deunionization are rather economic or political (see e.g. Wallerstein and Western, 2000). In this chapter, we will equally distinguish between three dimensions of globalization, using an updated version of the index used in Dreher and Gaston (2005).

Contradictory findings to the analysis of Dreher and Gaston (2005) are reported in the preceding empirical studies by e.g. Wallerstein and Western (2000) or Golden (2000). Wallerstein and Western (2000) study the development of union density and coverage during the post-war period until 1992 for 18 OECD

countries. They find that, first, an increase occurred until the seventies, followed by a decline in the eighties, on average. Wallerstein and Western (2000) provide then verbal-descriptive arguments for why trade openness may have such a positive or negative impact. Similarly, in a cross-section of 15 OECD countries for the 1980s (1980-1990) Golden (2000)'s empirical model reveals a convergence of union strength towards a certain mean, but a divergence in union density. In her study, this union development appears rather unaffected by growing economic integration (measured by trade openness and the absence of restrictions of capital mobility).

In the light of our research question, the main critique of these preceding studies is that none of them provides a direct linkage between the phenomenon 'globalization' and the economic outcome 'employment protection' through laws and administrative regulations: In particular, these studies focus largely on aspects of union strength – aiming to capture wage levels, wage inequality, and job security (e.g. Blau and Kahn, 1996; Fortin and Lemieux, 1997) as labor market outcomes of globalization – in other words, these studies merely assume a positive link between unionization and labor protection, but fail to empirically show that this link actually exists.

These studies do also not account for the multifacetedness of globalization, focusing on either trade or FDI, ignoring additional economic channels of globalization and their interplays. In addition, these studies entirely neglect the social and political aspects of globalization. Furthermore, the literature either largely disregards worker heterogeneity or focuses only on differential effects, if at all, on low-skilled and high-skilled workers, and ignore effects on different sectors of the labor market. Finally, from a methodological viewpoint, most of these studies do not take the problem of potential endogeneity of international trade into account, as the study by e.g. Dewit et al. (2009) suggests.[5]

Taken altogether, an issue that has not yet been in the focus of empirical studies on the effects of economic integration is legislation that aims at protecting average workers' employment. In addition, previous studies have approximated

[5]Their empirical analysis for OECD countries with the same index of employment protection used in this study suggests that relatively stricter protection of workers' rights deters foreign direct investment, and keeps domestic firms anchored in their home countries.

international economic integration only incompletely. To fill this gap, we address the question to what extent globalization (in place of international trade) affects workers' employment protection (in place of union power or child labor). While the violations of core labor standards employed in the previous literature (e.g. child labor) rather address differences between developed and developing countries, we use a measure of employment protection that varies even across economically and institutionally well advanced countries: Employment protection of workers measures e.g. the difficulty of (unfairly) dismissing them, their rights for compensation payments, and their exploitation through 'flexible contract' arrangements. To take account of the economic phenomenon of a growing importance of temporary work contracts in the European economies, we do not only look at the protection of regular (mostly permanent-contract) employment, but equally analyze the effects for short-term contracts and temporary work agency (TWA) employment. By using the sub-indices of the KOF Index of Globalization[6], we take account of the multifacetedness of economic integration that goes beyond simple trade openness and foreign direct investment flows. In addition, using this index allows us to study whether the effects of globalization differ across its various dimensions, specifically its economic, social and political dimensions. A battery of robustness tests completes the empirical analysis.

2.3 Theoretical Framework and Hypotheses

As argued above, strict employment protection legislation comes at a cost to domestic firms, possibly leading to their competitive disadvantage. Producers will hence lobby for a reduction of employment protection the stronger, the more intense international economic integration is. Workers can be assumed to have an interest in strong labor protection, in being employed in the regular sector and in being employed in the first place. Consequently, if their jobs are put under competitive pressure due to economic globalization, we suspect that workers will favor policies that ensure the international competitiveness of their

[6]See Dreher (2006).

jobs and that keep regular employment contracts relatively more attractive than short-term ones for the producers.

Combining these interests of the electorate, we conjecture politicians to introduce policies that decrease overall employment protection,[7] but that increase labor protection in the atypical employment (limited-term contract and temporary work agency) sector relative to protection in the regular sector. The latter aspect is facilitated by the fact that regulation in the relatively new atypical employment sector is initially quite low, i.e. politicians deliberately set incentives for employers that are overall welfare-improving: Politicians might relatively increase regulation in the temporary-contract sector with the intention to make employers not substitute regular employment with short-term contract/temporary work agency (TWA) positions. This argument rests on the stylized fact that, even though employment protection for the regularly employed has declined over the last years, their job security still remains substantially higher than that for those in 'atypical' employment.

Similar reasoning can be derived from a more political economy approach. Domestic politicians and unions might trade off the detrimental effects of globalization in one sector with stronger protection in the other sector. Although the share of the active labor force with temporary employment and atypical work contracts has increased over the last 20 years in developed countries (according to Franco and Winqvist (2002), in the EU-15 the share of temporary employment in total dependent employment has risen from 4 percent in 1983 to 15 percent in 2007),[8] employment in the regular sector is still by far larger than in the atypical sector. It may thus well be that producer-supporting politicians buy support of the electorate for labor market deregulation in the (traditional and economically more important) regular employment sector by granting stronger employment protection in the 'younger' temporary employment sector, – a strategy, which, given this latter sector's minor economic importance, still leads to an increase

[7] A conjecture which is supported by the weakening effect of international trade on some core labor standards (Busse, 2004).

[8] Recent numbers for Germany (2008) indicate that the share of regularly employed (permanent contracts with at least 20 working hours per weak) has declined since 1998 from 72.6 percent to 66 percent, while the share with 'atypical' contracts has increased from 16.2 per cent to 22.2 per cent. The same study reveals that the atypically employed earns only about 2/3 of the wage of a regularly employed (see Statistisches Bundesamt, 2009).

in overall labor market flexibility.

From a theoretical political economy viewpoint, the hypothesis that globalization exerts a protectionist impact on one labor market sector, but a deregulative one on the other, can be derived from linkage politics. This phenomenon was first described in the political science and political economy literature on international negotiations between two countries. Stein (1980) argues that consent to a specific reform or treaty that benefits one group (here: the producers) can be reached by linking the decision to reciprocal consent on a second reform that benefits the other group (here: the workers/the unions). Mayer and Riezman (1987) take a more formal approach and find that such policy mixtures (two interlinked reforms) constitute an equilibrium outcome of a bargaining game between two players, which makes both players better off compared to a situation without an agreement and without any reform.

Hence, we formulate the following hypotheses concerning overall globalization:

> Hypothesis 1: Globalization leads to an overall decrease of employment protection.

> Hypothesis 2: Globalization leads to a relative increase in protection of the temporary sector to protection in the regular sector.[9]

Applied to the subject of this study, 'linkage politics' interpretation above rests on the general assumption that unions and workers might prefer stricter regulation, whereas the opposite is the case for producers. Lobbying pressure exerted by producers may be the stronger, the fiercer international competition and economic globalization is. This is the reason why we formulate the following hypothesis concerning economic globalization:

> Hypothesis 3: Economic globalization leads to an overall decrease of employment protection in both sectors.

[9]Note: This does not exclude a decrease in both sectors, if the decrease is larger in the regular sector than in the atypical sector.

In contrast, the lobbying pressure exerted by unions or the dependently employed might rise with exposure of a wider public to the forces of globalization, reflected in the social dimension of globalization. People may mainly experience or become aware of globalization through own cross-national travel and information exchange through mass media and the internet. Notably, without this international communication infrastructure, the existence and success of non-governmental organizations such as attac, Greenpeace or Amnesty International would be unthinkable. Hence, political and social globalization might lay the grounds for an international coordination of workers' demands and a more forceful formulation, based on a larger support, of demands for an increase in labor protection. A similar argument does also hold for producers. The easier international policy coordination becomes, the easier it is to sustain higher levels of labor protection, as the cost of protection, if it equally applies to all international producers, ensured by international treaties, does not bias international trade.

Social and political globalization might even increase labor protection, if countries with stricter regulation manage to impose an increase in regulation on other countries through international organizations, which are a key aspect of political globalization. This often implies the signing of agreements to promote the integration of markets (e.g. the EU), but also to strengthen core labor standards (e.g. the ILO conventions). Put differently, such international organizations might help the international coordination and harmonization of labor standards, preventing a race-to-the-bottom among economically well advanced countries, or even increasing standards overall. Hence, we formulate the following hypotheses:

> Hypothesis 4: Political globalization has a non-negative effect on employment protection.

> Hypothesis 5: Social globalization has a non-negative effect on employment protection.

In a second step, we investigate whether the forces of globalization interplay with the economic and political condition a country is in, or whether the effects

of globalization are independent from such developments at the local level. In particular, we test whether globalization aggravates the pressure to liberalize labor markets exerted by growing unemployment spending. In addition, we conjecture that the adverse effects of globalization are diminished if national governments are left-wing.

2.4 Data and Empirical Strategy

2.4.1 Employment Protection Legislation

For our analysis, we use the index of Employment Protection Legislation (EPL), Version 1, provided by OECD (2004) for 28 OECD countries, from 1985 to 2003.[10] The EPL is based on government information and measures, in general, the protection of workers against specific forms of economic and financial exploitation through their employers.[11]

For regularly employed workers, the relevant EPL index ('EPL_{reg}') measures the overall strictness of protection with respect to four areas: The difficulty of individual dismissals, notice and severance pay for no-fault individual dismissals, the overall strictness of protection against dismissals, and regular procedural inconveniences. Thus, this measure takes into account the possible reasons for an individual lay-off, the regulation of advance notice and severance pay, trial periods, conditions under which lay-offs are unjustified, and compensation payment in case of such unjustified dismissals.

In contrast, for workers holding fixed-term work contracts or that are employed by temporary work agencies (so-called atypical work contracts), EPL

[10] The excluded countries are Iceland and Luxembourg with no observations of EPL. The included countries are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, South Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States of America.

[11] This index excludes aspects of mass dismissals that are taken into account in a more recent version of the EPL index ("Version 2"), which, however, covers a much smaller time span. The first time point of measurement of EPL version 2 is 1998, that of version 1 the year 1985. Notably, as stated in OECD (2004) p.102, the regulation of mass dismissals forms only an additional protection against a rather rare form of lay-off, and in many countries regulations of individual and mass dismissals are fairly identical.

('EPL_{temp}') captures the overall strength of restrictions on establishing and maintaining such temporary employment. OECD names the three areas covered by this EPL index 'fixed-term contracts', 'overall strictness of regulation', and 'temporary work agencies'. These areas include the regulation of the number of possible renewals of fixed-term contracts, the maximum accumulated contract duration (in months), whether fixed-term contracts are generally permitted or restricted to certain industry sectors only, or restricted to certain types of work (e.g. to temporarily replacing a long-term sick worker or a worker on parental leave).

Each EPL index (EPL_{reg}, EPL_{temp}) ranges from 0 to 6 with continuous intervals, and higher values indicate a stronger employment protection of workers. In general, each EPL index is calculated as an average of points awarded to its specific sub-dimensions in a four-step aggregation procedure (see OECD, 2004, chapter 2). Due to the four-step construction procedure of the index, small changes in the overall index may reflect considerable institutional changes: For example, a change from the oral notification of dismissal to a procedure where a written statement giving reasons must be provided and a work council must be notified increases the EPL index of regular employment by just 0.33 points (see also OECD, 2004, p. 103 and p. 106). Similarly, a move from restricting the number of (consecutive) short-term contracts renewals to having no restrictions decreases the EPL for temporary employment by only 0.125 points. Table 2.10 of Section 2.8 provides descriptive statistics of the indices of employment protection in OECD countries.

An overview of the legal and institutional changes in OECD countries with respect to employment protection from 1985 on is reported in Table 2.9 in section 2.8. Table 2.9 also illustrates in what directions these institutional changes influenced the two EPL indices of regular and temporary employment. The general impression is that, on average, since 1985 the EPL index has been falling, for either type of employment. However, in some countries specific labor market reforms had a neutral effect on the index (e.g. Belgium, Germany, Ireland, Japan, Norway, Sweden), while, contrary to the general impression, a few reforms even improved on workers' employment protection (Australia, France, Great Britain, New Zealand). Notably, the effects of these labor market reforms

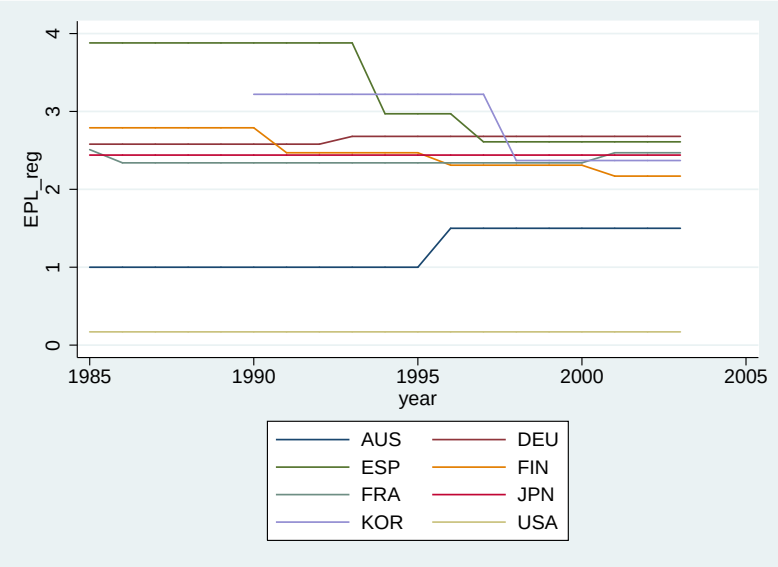
are not even heterogeneous across countries or time, but also within a country across types of employment. For example, Finland and Portugal appear to have liberalized the regular employment sector, while the employment protection index for temporary employment remained unaffected. Similarly, in Korea the reduction in protection in the regular sector was significantly larger than in the temporary sector. The exact opposite observation is made for Germany, Italy and Japan, in which only the protection of the temporarily employed was lowered. Figures 2.1 and 2.2 show the development of employment protection in both sectors for a selection of countries. Figure 2.1 displays the development of employment protection in the regular sector during the time span studied. There is substantial variation between the countries. Within the time series, we see that employment protection has stayed constant over time in some countries (Japan, USA), regardless of the initial level of regulation in these countries, while others have seen substantial decreases in protection (Finland, Korea, Spain), and a few countries have even experienced small increases in employment protection (Australia, Germany, France). Furthermore, there seems to be a convergence to a common level of labor protection for the European and Asian countries, decreasing average employment protection in the regular sector.

Figure 2.2 shows the development of regulation in the atypical employment sector between 1985 and 2003. There is substantial variation between the countries, even larger than in the regular employment sector. We also see substantial deregulation in some countries (Germany, Japan and to some extent Korea), while there has been no change in countries that already had a low level of regulation at the beginning of the time span of the sample (Australia, Finland, USA). In France, regulation has increased, while in Spain, an increase followed a decrease in regulation. Hence, there seems to be no clear trend in the change in regulation in this sector.

2.4.2 Globalization: Economic, Political and Social Dimensions

Globalization is measured by the annual KOF Index of Globalization developed by Dreher (2006), which measures the degree of globalization from 1970 onwards, on a 0 to 100 scale. Its three sub-indices cover a country's economic, po-

Figure 2.1: *Employment protection, regular employment, selected countries, 1985–2003*



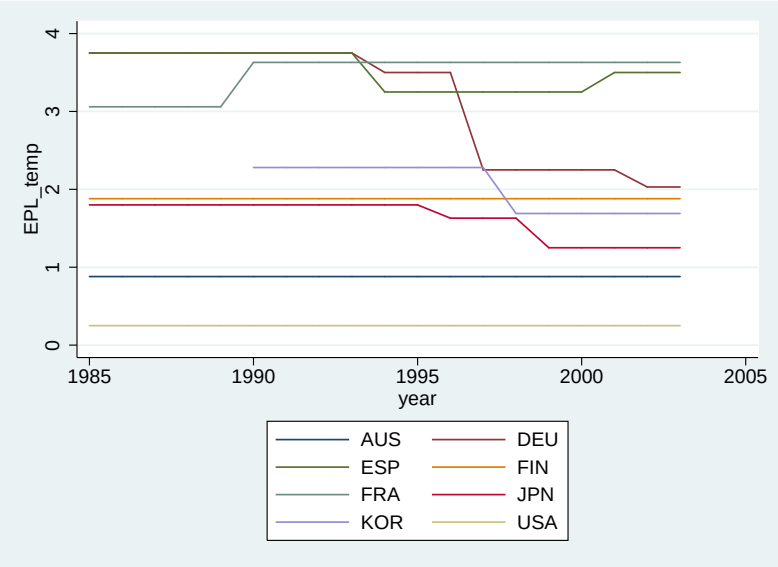
Source: OECD (2004), own calculations.

litical, and social dimensions of globalization. All three dimensions contribute with equal weights to the overall index of globalization.[12]

Economic globalization includes not only the traditional aspects of cross-national flows of goods and services, but also measures of foreign investment (direct, portfolio), the absence of traditional barriers to trade and capital flows, as well as indicators of internationalization of a country's labor force. The political dimension of globalization is captured mainly by a country's number of memberships in international organizations, foreign embassies, and participations in UN peace missions. Finally, social globalization aims at measuring the spread and exchange of ideas, values, images and people. This aspect is captured by, for example, fast food chain prevalence (as indicator of U.S. culture influence), cross-national trade in books and newspapers, but also international tourism and number of internet users. Overall, aspects of social globalization can be grouped into 'personal contacts', 'information flow' and 'cultural proximity' (see also Dreher and Gaston, 2005).

[12]The index is now widely used, e.g. by Aidt and Gassebner (2007), Torgler (2007), Gemmell et al. (2008) and Lamo et al. (2008).

Figure 2.2: *Employment protection, atypical employment, selected countries, 1985–2003*



Source: OECD (2004), own calculations.

Table 2.10 of Section 2.8 at the end of this chapter provides descriptive statistics of the globalization measures in our sample of OECD countries, which all endorse the principles of free trade. The index of economic globalization has a considerably large mean of 73.5 points, but ranges still from 37.8 to 96.0, resulting in a standard deviation of 12.5. The development of globalization is not uniform in our sample: the speed by which a nation opened itself economically (as well as politically and socially) varies by country and world region, even among OECD member states which share, by definition of their membership, similar economic and political institutions.

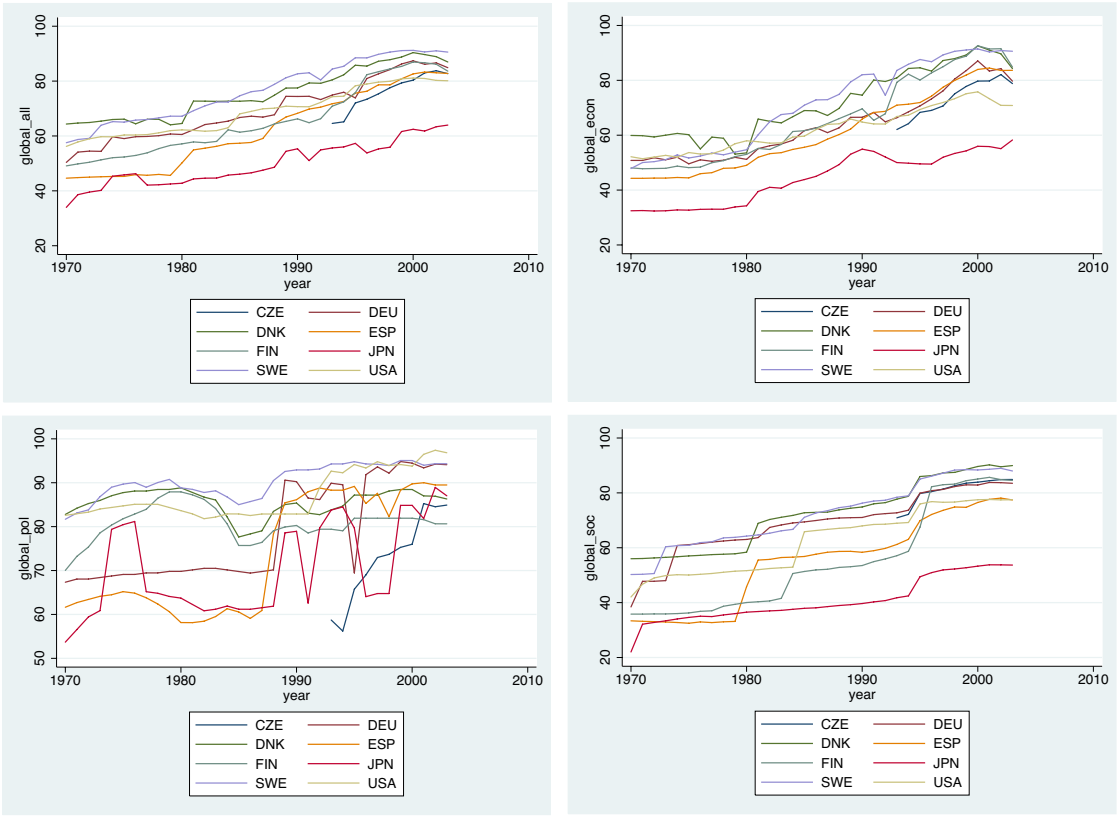
Figure 2.3 shows the development of overall globalization and its three subcategories for the same selection of countries as in Figure 2.1 and 2.2 from 1970 to 2003. Generally, we see substantial variation both between countries and within the time series, and a trend towards a higher level of globalization in all four panels. Except for social globalization, Japan seems to be far less internationally integrated than the rest of the countries. The US, starting with a relatively high level of globalization in all fields, is overtaken by all countries except for Japan in overall, economic and political globalization over time. At

the end of the period studied, even the former communist-block Czech Republic is more globalized in these fields, after a rapid catch-up during the nineties, than the US. Also Spain has experienced a substantial increase in international integration, both in absolute terms and relative to other countries. The Scandinavian countries show the highest level of overall, economic and political globalization. Somewhat different from the other three panels is the graph for political globalization. Here, there is no time trend, and large variation in the time series for some of the countries. Here, however, the US is in the top position both at the beginning and at the end of the time series, while the Scandinavian countries are only in the midfield. The pattern for Spain and the Czech Republic is the same as in the other fields of globalization: A large absolute and relative increase in social globalization. Hence, there is not only substantial variation within the time series and across countries, there is also variation over time in the relative levels of globalization between the single countries, i.e. variation in the data is not only cross-sectional (constant distance between lines), but also across time (local differences in steepness), even when the model includes time fixed effects that take out the common development pattern.

2.4.3 Controlling Variables

In this analysis, as controlling variables we also employ data on unemployment rate, unemployment benefit spending (as share of gross domestic product (GDP)), population size, and national income (GDP), its 5-year growth rate, all obtained from the World Bank's World Development Indicator (WDI) database (World Bank, 2009). Furthermore, we measure the political leaning of the government in two different ways. First, we use a dummy indicating a left-wing government, which has been constructed from data available in the updated version (2005) of Beck et al. (2001). Second, we use the index developed in Bjørnskov (2008), which is based on the number of seats held by the parties in government and, thus, continuous. This index of government ideology ranges between the values -1 and 1, where -1 indicates a fully left-wing government and 1 a right-wing government. Although the maximum number of observations is 486 country-years, due to some missing values in the remaining ex-

Figure 2.3: *Globalization and its sub-components, 1970–2003*



Source: KOF Index of Globalization (Dreher, 2006), own calculations.

planatory variables, we obtain an unbalanced panel with a maximum of 480 observations. The unemployment rate and unemployment spending (in log), are used to proxy pressure to loosen employment protection emerging from the situation in the domestic labor market, where the unemployment rate is meant to proxy pressure coming from the electorate, while unemployment spending is supposed to proxy budgetary pressure. We furthermore control for the five year GDP growth rate and national income, as faster growing and richer countries are more likely to have strong unions, possibly leading to stricter employment protection (see Dreher and Gaston, 2005; Wallerstein and Western, 2000).[13] We

[13]The direct inclusion of unionization as a controlling variable would reduce the sample size from 26 to 20 countries. We introduce unionization in a separate regression as a robustness check later. The main results remain the same.

use the five year growth rate as we want to control for structural aspects of the economy. The business cycle is controlled for by the unemployment rate and year fixed effects. We also include the logarithm of the population size that accounts for the size of the domestic market, with a larger domestic demand possibly implying less 'need' for domestic firms to internationally expand and hence lower competitive pressure by foreign competitors on domestic labor standards. The exact definitions of the variables in the empirical model and descriptive statistics are provided in Table 2.10.

2.4.4 Model

In our model we view employment protection legislation in country i at time t (EPL_{it}) as a function of globalization in the same country ($GLOB_{it}$), and a set of country-specific controlling factors (X_{it}) that might be correlated with both the focal variable and the dependent variable. Country (FE_i) and year (T_t) fixed effects account for unobserved country heterogeneity due to time-invariant national characteristics (such as certain labor market regulations and features of the insurance system) and year-specific (but country-unspecific) factors (such as world-wide economic shocks). A preliminary Hausman test rejected the random effects specification in favor of the fixed effects model, which we employ. An F-test of joint significance indicates that the year effects should not be omitted from the equation.[14] An error term (ϵ_{it}) completes the model.

Potential simultaneity might bias the estimated coefficient vector. We address this issue by employing country fixed effects and lagging the explanatory variables by two periods.[15] This specific lag structure is chosen on theoretical grounds, particularly because in most OECD countries the legislature period is four years, so that a 2-year lag might account for the duration of the legislating process and politicians' response time to changes in their party majorities triggered by new economic developments, particularly changes in the degree of globalization. Furthermore, as robustness test for the effects of globalization

[14] A Tobit model would yield inconsistent estimates due to the inclusion of fixed-effects.

[15] Lack of suitable instruments does not allow for testing the exogeneity assumption. Although the dependent variable may be viewed as truncated below 0 and above 5, a fixed effects estimation using unconditional Tobit might yield biased estimates.

we estimate a more parsimonious model that excludes some of the potentially endogenous determinants. The complete model looks as follows:

$$EPL_{it} = \alpha + \beta GLOB_{it-2} + \gamma X_{it-2} + FE_i + T_t + \epsilon_{it}, \tag{2.1}$$

where EPL_{it} denotes the different indices of employment protection, and $GLOB_{it-2}$ is the respective (sub-)index of globalization. The vector X_{it-2} contains the controlling variables, FE_i and T_t represent country and time fixed effects, ϵ_{it} is the error term, α is a constant and β and γ are parameters.

2.5 Results

2.5.1 Main Results

In general, the results of our estimations confirm our predictions made in Section 2.3. In Tables 2.1 and 2.2 we find empirical support for our hypotheses. According to Table 2.1, column 1, the protection of regular employment appears lowered by globalization, while column 1 of Table 2.2 suggests that the net effect of globalization on protection of the temporarily employed is not significantly different from zero, leading to an overall decrease of employment protection in the economy, but also to a relative increase of protection in the atypical sector compared to the regular sector. This supports Hypotheses 1 and 2.

For the regularly employed, we find the protection-lowering effect of overall globalization (Table 2.1 column 1) to be driven by all sub-dimensions, economic, political and social globalization. All three exert a significant negative impact on employment protection - independently as well as when simultaneously included in the regressions (Table 2.1 columns 2 to 5). Simultaneous inclusion lets us rule out the possibility that one dimension simply proxies the other in the single dimension regressions (Table 2.1, column 2).[16] For the regular employment sector, a simple comparison of the estimated coefficients indicates

[16]The similarity of coefficients on globalization measures across models 2, 3, 4, and 5 suggests that the three dimensions do not approximate each other in the single-dimension regressions, despite of their considerable correlation, particularly of the economic dimension with the political one (rho = 0.72).

Table 2.1: *Globalization and protection of regularly employed, 1985–2003*

	(1)	(2)	(3)	(4)	(5)
Log GDP (-2)	-0.345	-0.224	-0.588**	-0.732***	-0.827***
	[1.21]	[0.79]	[2.13]	[2.62]	[2.97]
Unemployment rate (-2)	0.003	0.006	0.007	-0.002	-0.001
	[0.48]	[1.03]	[1.15]	[0.39]	[0.14]
Log unemployment spending (-2)	-0.087***	-0.100***	-0.130***	-0.087***	-0.099***
	[2.75]	[3.11]	[4.07]	[2.63]	[3.03]
GDP growth (-2)	0.006	0.002	0.018	0.024	0.027*
	[0.39]	[0.13]	[1.19]	[1.57]	[1.74]
Left-wing government (-2)	0.051***	0.054***	0.042**	0.053***	0.042**
	[2.60]	[2.77]	[2.13]	[2.62]	[2.07]
Globalization, overall (-2)	-0.021***				
	[5.73]				
Economic glob. (-2)		-0.014***	-0.013***		
		[5.27]	[4.93]		
Political glob. (-2)		-0.007***		-0.006***	
		[3.71]		[3.22]	
Social glob. (-2)		-0.004*			-0.005**
		[1.83]			[2.28]
Constant	7.144***	6.336**	8.610***	9.459***	10.148***
	[2.88]	[2.57]	[3.49]	[3.77]	[4.05]
Observations	401	401	401	401	401
Number of countries	26	26	26	26	26
R-squared (within)	0.24	0.26	0.23	0.20	0.18

Notes: Dependent variable is the Employment Protection Index for regularly employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

that economic globalization has quantitatively the largest effect on employment protection. The size of the effect is quite considerable: An increase in economic globalization (running from 0 to 100) by 10 score points lowers employment protection by roughly 0.14 points, a change in EPL that could be triggered by e.g. liberalizing the dismissal procedure from one in which a third party approval is required to a regulation according to which only a simple notification of a work council is needed (decreases EPL by 0.15 points).

Taking the results of Table 2.1 together, mainly economic, but to some extent also political and social globalization appear to weaken the laws protecting regular employment. This finding is in support of traditional and political economy models of international trade suggesting that fiercer international market competition makes domestic firms lobby for more domestic labor market flexibility, and supports our hypotheses 3, 4 and 5.

In contrast, Table 2.2 shows that protection of fixed-term and temporary-work-agency employed workers ('atypical contracts') is not affected by global-

Table 2.2: *Globalization and protection of atypically employed, 1985–2003*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log GDP (-2)	2.700***	2.908***	3.615***	2.616***	2.783***
	[3.31]	[3.59]	[4.63]	[3.37]	[3.61]
Unemployment rate (-2)	-0.016	-0.001	-0.002	-0.011	-0.014
	[0.98]	[0.05]	[0.14]	[0.68]	[0.87]
Log unemployment spending (-2)	-0.162*	-0.239***	-0.179**	-0.194**	-0.170*
	[1.78]	[2.60]	[1.98]	[2.12]	[1.88]
GDP growth (-2)	-0.100**	-0.107**	-0.139***	-0.097**	-0.102**
	[2.24]	[2.43]	[3.24]	[2.27]	[2.37]
Left-wing government (-2)	0.062	0.048	0.067	0.043	0.068
	[1.09]	[0.85]	[1.19]	[0.77]	[1.21]
Globalization, overall (-2)	0.013				
	[1.24]				
Economic glob. (-2)		-0.019**	-0.019**		
		[2.46]	[2.55]		
Political glob. (-2)		0.011**		0.013**	
		[2.06]		[2.43]	
Social glob. (-2)		0.011*			0.011*
		[1.93]			[1.93]
Constant	-23.918***	-25.213***	-29.574***	-23.264***	-24.524***
	[3.35]	[3.57]	[4.24]	[3.34]	[3.54]
Observations	401	401	401	401	401
Number of countries	26	26	26	26	26
R-squared (within)	0.31	0.34	0.32	0.32	0.31

Notes: Dependent variable is the Employment Protection Index for atypically employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

ization, measured by its general index (column 1), in line with Hypothesis 2. However, this time it is not the economic dimension of globalization that gives rise to this finding, which again exerts a negative effect (Table 2.2 column 3), in line with Hypothesis 3. Instead, it is the social and political dimensions of globalization that strengthen employment protection (Table 2.2, columns 4 and 5), outweighing the labor standards lowering effect of economic globalization. This supports hypotheses 4 and 5. Again, an increase in political or globalization of 10 points would result in an substantial increase in EPL for 'atypical' forms of employments that mirrored, for example, restricting the number of contract renewals, or changing the maximum of cumulated contract duration from 'no limitation' to '24 months' (= + 0.125 points). Column 2 includes all three dimensions of globalization. It confirms the preceding single-dimension analyses, i.e. the zero net effect of globalization on protection of temporary employment, being driven entirely by its non-economic dimensions (social and political).

Taking the results of Table 2.2 altogether, we find support for hypotheses 3-5. Globalization in its social and political dimensions puts an upward pressure on protection of workers with 'atypical' contracts. In contrast, the economic dimension appears to decrease labor standards, yielding a zero net effect of globalization on labor protection in this sector.

Combining the results of Tables 2.1 and 2.2, we find that economic globalization decreases labor protection, while political and social globalization influence protection negatively in the regular sector, and positively in the atypical sector, leading to a relative increase of protection in the latter sector compared to protection in the first sector.

Turning to the effects of our controlling variables, we observe some similarities and some dissimilarities across the two different labor market segments. For both segments, Tables 2.1 and 2.2 show that a larger burden of unemployment spending in the economy, measured as share of GDP, exerts a pressure to deregulate labor markets, while the unemployment rate seems to exert no effect. The negative correlation between the generosity of unemployment benefits and employment protection was already reported in OECD (2004, p. 92). Furthermore, we find that as countries grow richer, as measured by GDP, pro-

Table 2.3: *Globalization and protection of regularly employed, 1985–2003*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log GDP (-2)	-0.235	-0.111	-0.538*	-0.744**	-0.798***
	[0.78]	[0.37]	[1.84]	[2.50]	[2.67]
Unemployment rate (-2)	0.003	0.008	0.009	-0.004	-0.001
	[0.57]	[1.31]	[1.46]	[0.61]	[0.21]
Log unemployment spending (-2)	-0.077**	-0.092***	-0.127***	-0.076**	-0.092***
	[2.48]	[2.91]	[4.03]	[2.31]	[2.84]
GDP growth (-2)	0.004	0.001	0.020	0.025	0.027
	[0.25]	[0.05]	[1.22]	[1.47]	[1.62]
Right-wing govt., continuous (-2)	-0.084***	-0.091***	-0.067**	-0.060*	-0.054*
	[2.67]	[2.93]	[2.13]	[1.85]	[1.67]
Globalization, overall (-2)	-0.023***				
	[6.09]				
Economic glob. (-2)		-0.016***	-0.015***		
		[5.88]	[5.46]		
Political glob. (-2)		-0.007***		-0.006***	
		[3.78]		[3.07]	
Social glob. (-2)		-0.004**			-0.005**
		[2.13]			[2.42]
Constant	6.273**	5.493**	8.283***	9.585***	9.896***
	[2.38]	[2.11]	[3.20]	[3.61]	[3.71]
Observations	396	396	396	396	396
Number of countries	25	25	25	25	25
R-squared (within)	0.25	0.27	0.23	0.19	0.18

Notes: Dependent variable is the Employment Protection Index for regularly employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Political orientation of the government is measured by the continuous ideology index developed by Bjørnskov (2008). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 2.4: *Globalization and protection of atypically employed, 1985–2003*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log GDP (-2)	1.816**	1.970**	2.912***	1.697**	1.989**
	[2.07]	[2.27]	[3.51]	[2.07]	[2.40]
Unemployment rate (-2)	-0.023	-0.004	-0.006	-0.015	-0.021
	[1.44]	[0.21]	[0.34]	[0.94]	[1.31]
Log unemployment spending (-2)	-0.162*	-0.257***	-0.181**	-0.214**	-0.163*
	[1.80]	[2.81]	[2.02]	[2.35]	[1.81]
GDP growth (-2)	-0.076	-0.076	-0.118**	-0.069	-0.083*
	[1.59]	[1.61]	[2.56]	[1.49]	[1.78]
Right-wing govt., continuous (-2)	0.188**	0.186**	0.133	0.200**	0.177**
	[2.07]	[2.08]	[1.49]	[2.25]	[1.98]
Globalization, overall (-2)	0.016				
	[1.46]				
Economic glob. (-2)		-0.019**	-0.021***		
		[2.42]	[2.64]		
Political glob. (-2)		0.016***		0.018***	
		[2.80]		[3.13]	
Social glob. (-2)		0.010*			0.010*
		[1.76]			[1.73]
Constant	-15.906**	-16.928**	-22.898***	-15.205**	-17.000**
	[2.09]	[2.26]	[3.11]	[2.08]	[2.30]
Observations	396	396	396	396	396
Number of countries	25	25	25	25	25
R-squared (within)	0.31	0.34	0.32	0.32	0.31

Notes: Dependent variable is the Employment Protection Index for atypically employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Political orientation of the government is measured by the continuous ideology index developed by Bjørnskov (2008). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

tection of temporarily employed workers increases, as predicted. In contrast, an increase in a country's wealth is associated with a decrease in the protection of regularly employed. Economic performance in the past five years, as measured by the five year growth rate of GDP, seems to have no influence on protection in the regular sector, while an increase in the growth rate is associated with lower protection in the atypical sector (no causal interpretation intended here). For regular employment, supporting our reasoning above, we also find that left-wing governments tend to support a higher level of employment protection in the regular sector. In tendency, this effect is also observable for temporary employment, albeit statistically much weaker. When we employ a continuous variable as alternative measure of government ideology instead of the dummy variable (Tables 2.3 and 2.4), we find that right wing governments significantly decrease employment protection in the regular sector, and increase employment protection in the atypical sector.

Apparently, our analyses of the direct effects of globalization on employment protection show that the economic forces of globalization and international competition lower protection of both regular and temporary employment, as argued in Hypothesis 3. In contrast, it is the political and social dimensions of globalization that are most decisive for a stronger (relative) protection of employees with 'atypical' work contracts, which supports Hypothesis 5. Political international integration affects both labor market segments likewise: It works in the same protection lowering direction as economic globalization for regular employment, but strongly in the opposite direction for temporary employment. For overall globalization, we find a negative effect on protection in the regular sector, and a zero net effect in the atypical sector. These findings support Hypotheses 1 and 2.

2.5.2 Robustness

Our main results are robust to several changes in the specification of the regression and in the sample. The Tables presenting the results of the robustness check can be found in Section 2.8 at the end of this chapter. We obtain results that are qualitatively similar (in terms of coefficient sizes and direction of influence of

globalization measures) if a more parsimonious model is estimated that omits those variables that are potentially endogenous to employment protection, such as the unemployment rate, GDP growth, and left-wing ideology of the government (see Tables 2.11 and 2.12). Moreover, the findings are robust to estimating our models with a reduced sample that excludes the former communist countries Czech Republic, Poland, Hungary and Slovak Republic (see Tables 2.13 and 2.14); this test rejects the claim that our findings were driven by transition countries that, from 1991 on, underwent extreme changes in their international economic integration, as discussed in Section 2.4. The results are also qualitatively unaltered when we take the autocorrelation of the residuals into account or when we replace the dichotomous indicator of government ideology with a continuous measure (see Tables 2.3 and 2.4).

Our results remain also unaltered when we include union density as an additional control variable (see Tables 2.15 and 2.16). Again, we find a negative effect of the overall index of globalization on protection of regularly employed workers and an a zero net effect for the temporary-contract sector. Turning to the sub-indices of globalization, in line with our previous findings, the coefficients of economic, political and social globalization turn out negative and significant for the regular employment sector. For the atypical-contract sector, we find again that the negative effect of economic globalization is compensated by a positive effect of political globalization, the difference to our main results here being the now insignificant effect of social globalization.

2.6 The Aggravating Effect of Globalization on Employment Protection

The impact exerted by globalization might not only be direct, but also indirect. More specifically, the effects of domestic macroeconomic and political factors that weaken employment protection might be amplified through the pressures of the international market and international politics. Put differently, we can expect interplays of these domestic factors with the three dimensions of globalization. In the following we test this conjecture for unemployment spending

and a right-wing ideology of the government, both of which were previously found to lower employment protection, at least of the regularly employed.

Tables 2.5 through 2.8 show the results of this exercise. We employ the continuous measure of right-wing government ideology by Bjørnskov (2008) in place of the previously employed dichotomous indicator for left-wing governments. The models with the odd numbers (1, 3, and 5) report the findings for the baseline specification of Tables 2.3 and 2.4, while the models with the even numbers (2, 4, and 6) add interaction terms to the empirical model.

2.6.1 Globalization and Unemployment Spending

In Table 2.5, unemployment spending lowers protection of the regularly employed in all model specifications. This finding was already observed in Table 2.3. Indeed, inclusion of the interaction term with globalization makes this result even more statistically robust. Again, overall, economic, political and social globalization are negatively associated with employment protection of regular workers (columns 1 to 4).

In line with our hypothesis, we find negative (and significant) interaction terms between unemployment spending and the economic dimension of globalization for the protection of the regularly employed (column 2). Thus, stronger linkages with international markets aggravate the pressure to deregulate labor markets exerted by domestic macroeconomic structures such as a generous and budget-burdening unemployment benefit system.[17] Overall, the main finding of Table 2.5 is that in a globalized world particularly international economic linkages add to the pressure of a bad labor market performance to lower protection of regularly employed workers.

Table 2.6 analyzes the same question for workers with 'atypical' work contracts. As in Table 2.4, it is the political and social dimensions of globalization that lead to an increase in regulation of the temporary sector (columns 3 to 6), while the economic dimension decreases regulation (columns 1 and 2). Again, unemployment spending is associated with lower employment protection in

[17] As we have controlled for the unemployment rate, unemployment spending is also interpretable as a measure of generosity rather than sheer size.

Table 2.5: *Interaction between globalization and unemployment spending for regular employment, 1985–2003*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Log GDP (-2)	-0.235	-0.237	-0.538*	-0.688**	-0.744**	-0.684**	-0.798***	-0.807***
	[0.78]	[0.79]	[1.84]	[2.28]	[2.50]	[2.28]	[2.67]	[2.71]
Unemployment rate (-2)	0.003	0.005	0.009	0.007	-0.004	-0.004	-0.001	0.000
	[0.57]	[0.91]	[1.46]	[1.10]	[0.61]	[0.65]	[0.21]	[0.08]
Log unemployment spending (-2)	-0.077**	-0.095***	-0.127***	-0.127***	-0.076**	-0.081**	-0.092***	-0.105***
	[2.48]	[3.02]	[4.03]	[4.04]	[2.31]	[2.45]	[2.84]	[3.12]
GDP growth (-2)	0.004	0.005	0.020	0.023	0.025	0.022	0.027	0.029*
	[0.25]	[0.31]	[1.22]	[1.40]	[1.47]	[1.34]	[1.62]	[1.73]
Right-wing govt., continuous (-2)	-0.084***	-0.075**	-0.067**	-0.053*	-0.060*	-0.053	-0.054*	-0.051
	[2.67]	[2.38]	[2.13]	[1.66]	[1.85]	[1.64]	[1.67]	[1.57]
Globalization, overall (-2)	-0.023***	-0.025***						
	[6.09]	[6.52]						
Economic glob. (-2)			-0.015***	-0.012***				
			[5.46]	[3.83]				
Political glob. (-2)					-0.006***	-0.007***		
					[3.07]	[3.38]		
Social glob. (-2)							-0.005**	-0.006***
							[2.42]	[2.77]
*Globalization (-2) * log unemp. spending (-2)*		-0.003***		-0.004*		-0.002		-0.001
		[2.68]		[1.92]		[1.42]		[1.39]
Constant	6.262**	6.387**	8.266***	9.464***	9.574***	9.121***	9.883***	10.011***
	[2.38]	[2.44]	[3.19]	[3.56]	[3.61]	[3.42]	[3.71]	[3.76]
Observations	396	396	396	396	396	396	396	396
Number of countries	25	25	25	25	25	25	25	25
R-squared (within)	0.25	0.26	0.23	0.24	0.19	0.19	0.18	0.18

Notes: Dependent variable is the Employment Protection Index for regularly employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Political orientation of the government is measured by the continuous ideology index developed by Bjørnskov (2008). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 2.6: *Interaction between globalization and unemployment spending for atypical employment, 1985–2003*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Log GDP (-2)	1.816**	1.809**	2.912***	2.461***	1.697**	2.024**	1.989**	1.934**
	[2.07]	[2.10]	[3.51]	[2.87]	[2.07]	[2.46]	[2.40]	[2.36]
Unemployment rate (-2)	-0.023	-0.016	-0.006	-0.012	-0.015	-0.016	-0.021	-0.011
	[1.44]	[0.98]	[0.34]	[0.70]	[0.94]	[1.03]	[1.31]	[0.70]
Log unemployment spending (-2)	-0.162*	-0.235***	-0.181**	-0.180**	-0.214**	-0.240***	-0.163*	-0.236**
	[1.80]	[2.59]	[2.02]	[2.02]	[2.35]	[2.65]	[1.81]	[2.56]
GDP growth (-2)	-0.076	-0.073	-0.118**	-0.109**	-0.069	-0.081*	-0.083*	-0.072
	[1.59]	[1.54]	[2.56]	[2.37]	[1.49]	[1.76]	[1.78]	[1.55]
Right-wing govt., continuous (-2)	0.188**	0.226**	0.133	0.174*	0.200**	0.235***	0.177**	0.196**
	[2.07]	[2.51]	[1.49]	[1.91]	[2.25]	[2.64]	[1.98]	[2.21]
Globalization, overall (-2)	0.016	0.009						
	[1.46]	[0.80]						
Economic glob. (-2)			-0.021***	-0.012				
			[2.64]	[1.30]				
Political glob. (-2)					0.018***	0.012*		
					[3.13]	[1.95]		
Social glob. (-2)							0.010*	0.003
							[1.73]	[0.50]
*Globalization (-2) * log unemp. spending (-2)*		-0.014***		-0.011**		-0.010***		-0.008***
		[3.72]		[2.04]		[2.84]		[3.01]
Constant	-15.928**	-15.433**	-22.923***	-19.313**	-15.234**	-17.716**	-17.022**	-16.267**
	[2.09]	[2.06]	[3.11]	[2.56]	[2.08]	[2.43]	[2.30]	[2.23]
Observations	396	396	396	396	396	396	396	396
Number of countries	25	25	25	25	25	25	25	25
R-squared (within)	0.31	0.33	0.32	0.33	0.32	0.34	0.31	0.33

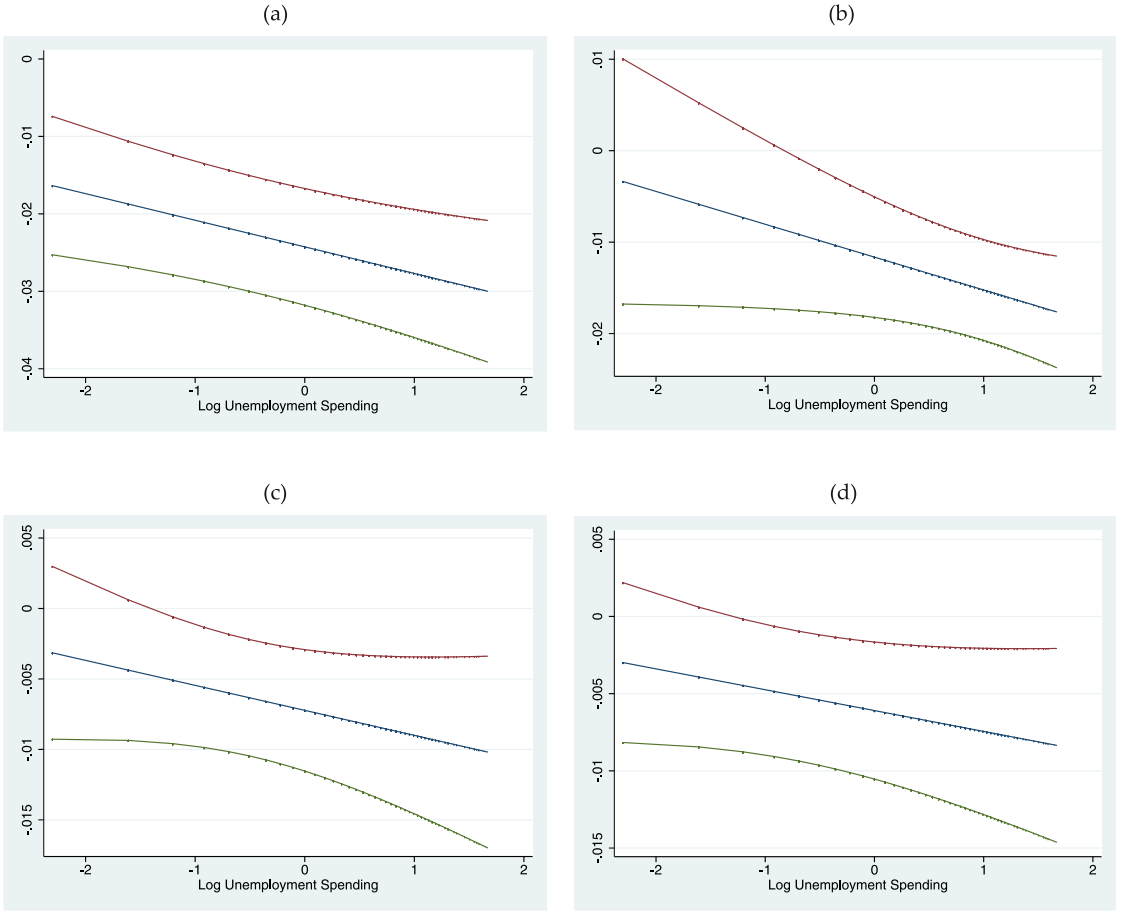
Notes: Dependent variable is the Employment Protection Index for atypically employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Political orientation of the government is measured by the continuous ideology index developed by Bjørnskov (2008). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

all regressions. The estimates of the interaction terms show that unemployment spending in its interplay with globalization lowers the protection of the temporarily employed (column 2). The same is the case when we look at the different dimensions of globalization separately. Unemployment spending aggravates the negative effect of economic globalization, and decreases the positive effects of political and social globalization, which turn insignificant if the interaction term is included (columns 4, 6 and 8).

While the coefficients of Tables 2.5 and 2.6 give the average effect of the interplay between unemployment spending and globalization, Figures 2.4 and 2.5 show the effect of the various measures of globalization on employment protection conditional on the size of unemployment spending. Figure 2.4 shows the effect on protection in the regular employment sector, Figure 2.5 illustrates the effect on regulation of the atypical employment sector. Panels (a)-(d) represent the regressions including measures of overall, economic, political and social globalization, respectively.

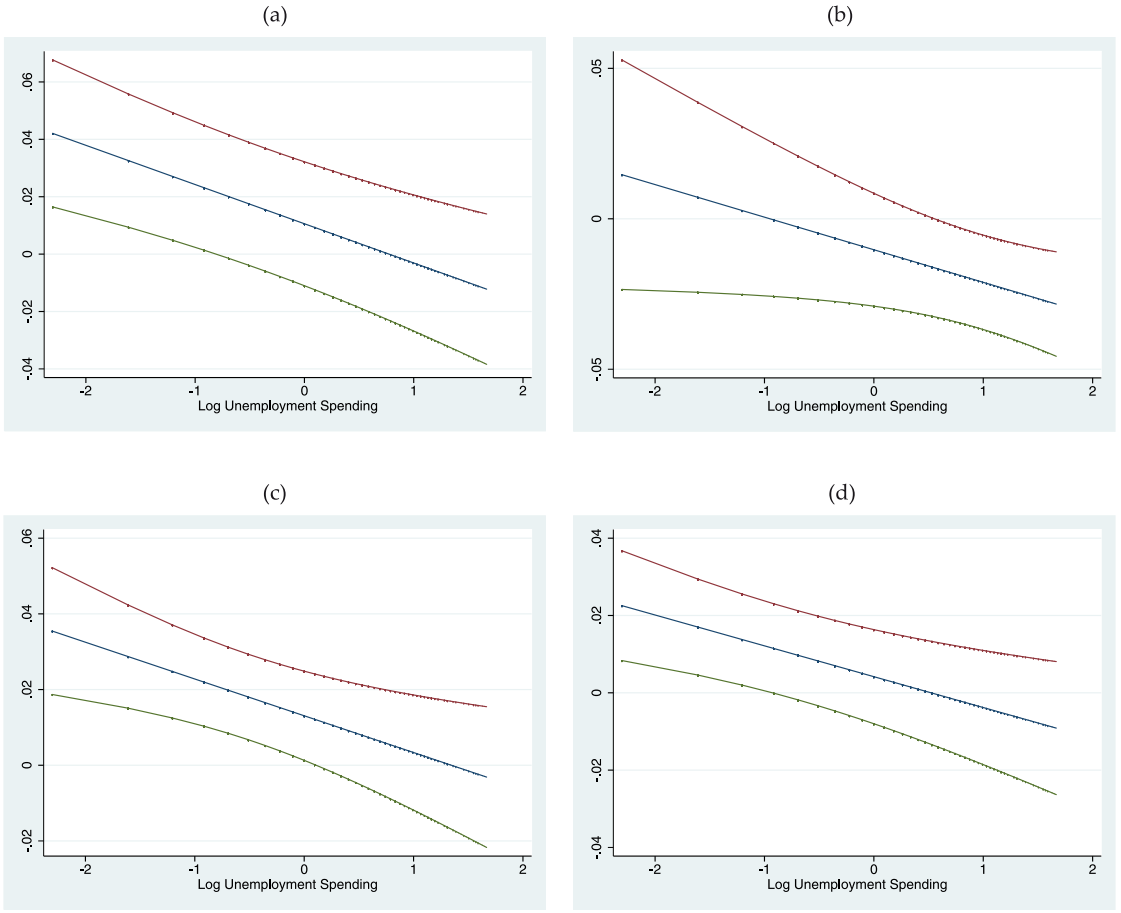
Figure 2.4 reveals that the effect is negative throughout, though statistically significant only for overall and economic globalization. Furthermore, we see that the magnitude of the negative effect increases with unemployment spending. Figure 2.5 shows that while the effect is negative and significant for all measures of globalization when evaluated at the mean, regulation seems to be tightened by an increase in globalization, the lower unemployment spending is.

Figure 2.4: *Marginal effects, interaction of globalization and unemployment spending, regular employment, 1985–2003*



Note: Graphs depict marginal effect of overall (a), economic (b), political (c) and social globalization (d) conditional on unemployment spending and the 90 percent confidence interval.

Figure 2.5: *Marginal effects, interaction of globalization and unemployment spending, atypical employment, 1985–2003*



Note: Graphs depict marginal effect of overall (a), economic (b), political (c) and social globalization (d) conditional on unemployment spending and the 90 percent confidence interval.

Taken altogether, Tables 2.5 and 2.6 and Figures 2.4 and 2.5 show that globalization interplays with the domestic macro-economic condition: the employment protection lowering effect of unemployment spending appears aggravated by the forces of globalization, by economic globalization for the regularly employed and by all dimensions of globalization for the temporarily employed.

2.6.2 Globalization and Government Ideology

Tables 2.7 and 2.8 include interactions between globalization and government ideology in the baseline model.

For the regularly employed, the odd numbered columns of Table 2.7 show the negative and significant direct effects of economic, political and social globalization on employment protection, which have already been observed in Table 2.3. Analogous to Table 2.3, the direct effect of right-wing government ideology on employment protection appears negative and significant. Looking at the interactions between globalization and government ideology, we find that employment protection is reduced further with increasing economic globalization, the more right-wing the government is (column 4). We find no such interaction effect for the political and social dimensions of globalization (columns 6 and 8) and for the overall index of globalization (column 2).

For the temporarily employed, as already shown in Table 2.4, social and political globalization increase regulation (columns 5 and 7 of Table 2.8), while economic globalization leads to a decrease in regulation (column 3). Again, right-wing governments are found to increase regulation in the temporary sector in all specification except for the one including economic globalization. Concerning the interaction terms, political globalization is found to increase the strengthening effect of right-wing governments on the regulation of short-term work contracts (column 6), or, put the other way round, right-wing government ideology aggravates the protection increasing effect of political globalization.

Taken altogether, investigating the interplay between the political positioning of national governments and globalization, with respect to employment protection of permanent contract workers we find that right-wing governments respond more strongly to the forces exerted by economic globalization, as one

Table 2.7: *Interaction between globalization and government ideology for regular employment, 1985–2003*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Log GDP (-2)	-0.235	-0.210	-0.538*	-0.547*	-0.744**	-0.721**	-0.798***	-0.771**
	[0.78]	[0.69]	[1.84]	[1.85]	[2.50]	[2.40]	[2.67]	[2.58]
Unemployment rate (-2)	0.003	0.003	0.009	0.009	-0.004	-0.003	-0.001	-0.001
	[0.57]	[0.60]	[1.46]	[1.45]	[0.61]	[0.59]	[0.21]	[0.18]
Log unemployment spending (-2)	-0.077**	-0.080**	-0.127***	-0.127***	-0.076**	-0.081**	-0.092***	-0.093***
	[2.48]	[2.54]	[4.03]	[4.02]	[2.31]	[2.41]	[2.84]	[2.87]
GDP growth (-2)	0.004	0.002	0.020	0.020	0.025	0.023	0.027	0.025
	[0.25]	[0.14]	[1.22]	[1.24]	[1.47]	[1.36]	[1.62]	[1.48]
Right-wing govt., continuous (-2)	-0.084***	-0.084***	-0.067**	-0.066**	-0.060*	-0.059*	-0.054*	-0.054*
	[2.67]	[2.68]	[2.13]	[2.12]	[1.85]	[1.84]	[1.67]	[1.68]
Globalization, overall (-2)	-0.023***	-0.023***						
	[6.09]	[6.06]						
Economic glob. (-2)			-0.015***	-0.014***				
			[5.46]	[5.01]				
Political glob. (-2)					-0.006***	-0.006***		
					[3.07]	[3.11]		
Social glob. (-2)							-0.005**	-0.005**
							[2.42]	[2.50]
*Globalization (-2) * right-wing govt. (-2)*		0.002		-0.006*		0.002		0.003
		[0.86]		[1.79]		[0.74]		[1.40]
Constant	6.251**	6.039**	8.266***	8.343***	9.569***	9.380***	9.881***	9.682***
	[2.37]	[2.28]	[3.19]	[3.19]	[3.60]	[3.51]	[3.70]	[3.63]
Observations	396	396	396	396	396	396	396	396
Number of countries	25	25	25	25	25	25	25	25
R-squared (within)	0.32	0.32	0.31	0.32	0.30	0.30	0.27	0.27

Notes: Dependent variable is the Employment Protection Index for regularly employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Political orientation of the government is measured by the continuous ideology index developed by Bjørnskov (2008). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 2.8: *Interaction between globalization and government ideology for atypical employment, 1985–2003*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Log GDP (-2)	1.816**	1.983**	2.912***	3.066***	1.697**	1.891**	1.989**	2.036**
	[2.07]	[2.26]	[3.51]	[3.67]	[2.07]	[2.30]	[2.40]	[2.45]
Unemployment rate (-2)	-0.023	-0.022	-0.006	-0.005	-0.015	-0.014	-0.021	-0.021
	[1.44]	[1.37]	[0.34]	[0.30]	[0.94]	[0.87]	[1.31]	[1.29]
Log unemployment spending (-2)	-0.162*	-0.178**	-0.181**	-0.182**	-0.214**	-0.250***	-0.163*	-0.164*
	[1.80]	[1.98]	[2.02]	[2.03]	[2.35]	[2.72]	[1.81]	[1.83]
GDP growth (-2)	-0.076	-0.088*	-0.118**	-0.127***	-0.069	-0.082*	-0.083*	-0.086*
	[1.59]	[1.84]	[2.56]	[2.74]	[1.49]	[1.77]	[1.78]	[1.85]
Right-wing govt., continuous (-2)	0.188**	0.187**	0.133	0.127	0.200**	0.202**	0.177**	0.177**
	[2.07]	[2.06]	[1.49]	[1.43]	[2.25]	[2.28]	[1.98]	[1.98]
Globalization, overall (-2)	0.016	0.016						
	[1.46]	[1.51]						
Economic glob. (-2)			-0.021***	-0.020**				
			[2.64]	[2.52]				
Political glob. (-2)					0.018***	0.017***		
					[3.13]	[3.03]		
Social glob. (-2)							0.010*	0.010*
							[1.73]	[1.68]
*Globalization (-2) * right-wing govt. (-2)*		0.016**		0.013		0.013**		0.005
		[1.99]		[1.44]		[2.26]		[0.86]
Constant	-15.856**	-17.262**	-22.863***	-24.237***	-15.152**	-16.723**	-16.953**	-17.292**
	[2.08]	[2.26]	[3.10]	[3.26]	[2.07]	[2.29]	[2.29]	[2.34]
Observations	396	396	396	396	396	396	396	396
Number of countries	25	25	25	25	25	25	25	25
R-squared (within)	0.31	0.32	0.32	0.32	0.32	0.33	0.31	0.31

Notes: Dependent variable is the Employment Protection Index for atypically employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Political orientation of the government is measured by the continuous ideology index developed by Bjørnskov (2008). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

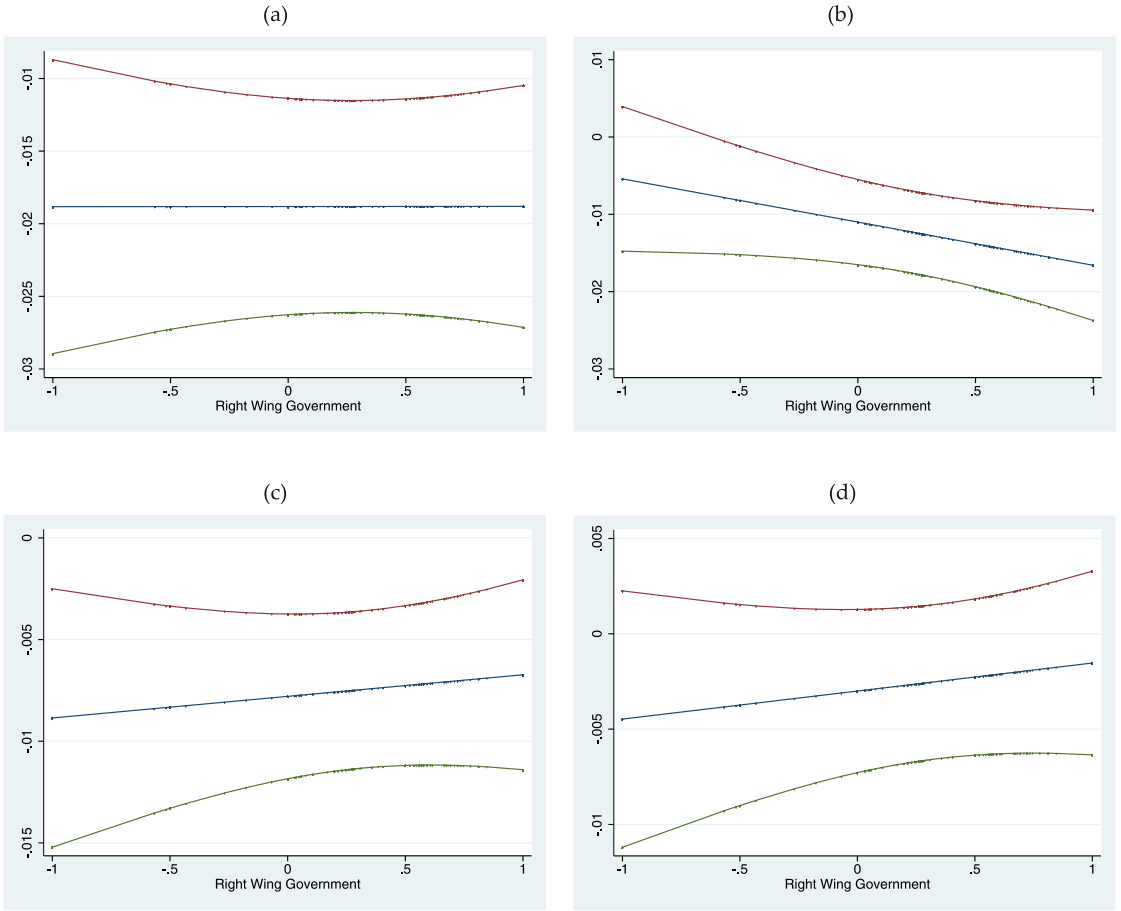
would expect. Put differently, left-wing governments attempt to counteract the liberalization pressure exerted by economic globalization.

For workers with atypical contracts, the protection-increasing effect of political globalization is reinforced by a right-wing government. This result indicates that the 'policy mixture' strategy (see Section 2.3) of particularly right-wing governments, which is to appease the work force and unions by stronger protecting the (economically far less important) 'atypical contract' employees, works the better, the stronger the political international integration of a country is, i.e. the better the politicians can signal their credibility to the opposing interest groups.

While the coefficients of Tables 2.7 and 2.8 give the average effect of the interplay between government ideology and globalization, Figures 2.6 and 2.7 show the effect of the various measures of globalization on employment protection conditional on government ideology. Figure 2.6 shows the effect on protection in the regular employment sector, Figure 2.7 illustrates the effect on regulation of the atypical employment sector. Panels (a)-(d) represent the regressions including measures of overall, economic, political and social globalization, respectively.

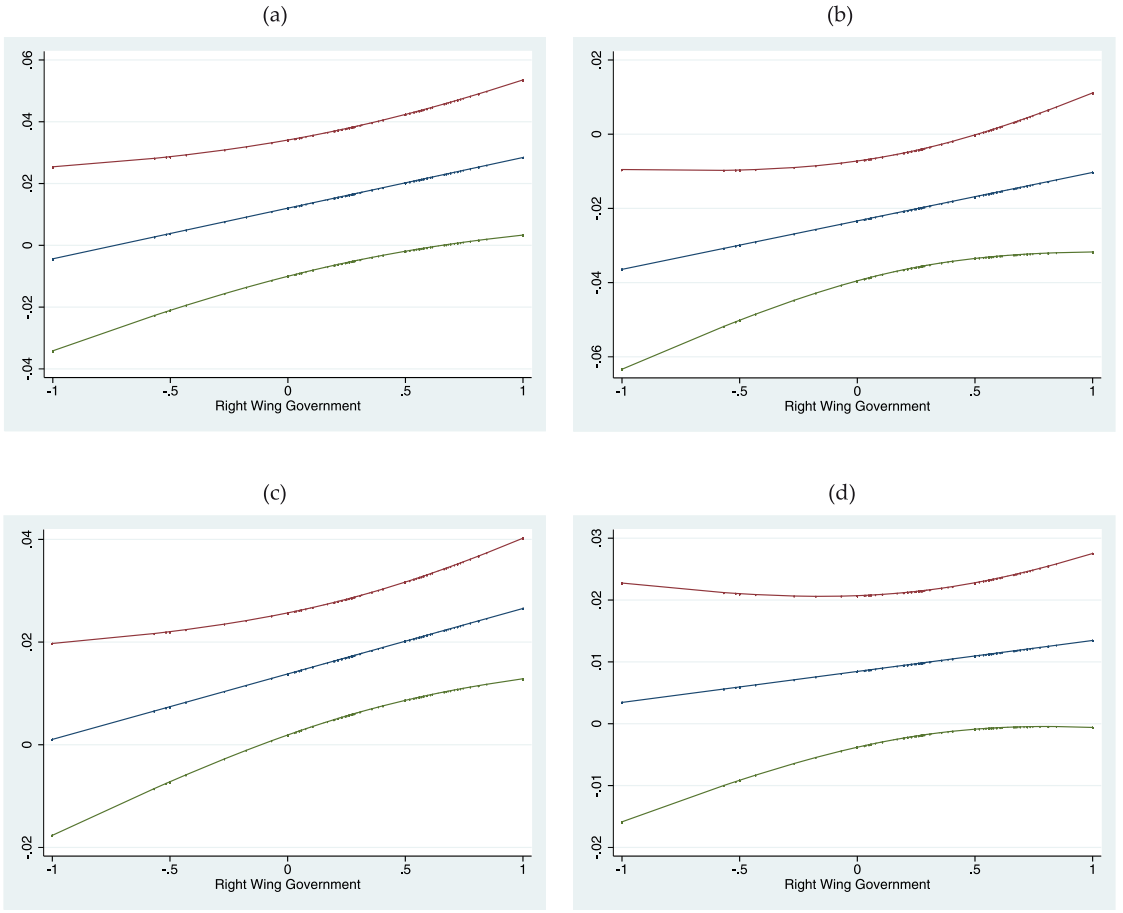
Panel (a) of Figure 2.6 reveals that the effect of overall globalization on employment protection in the regular sector does not vary conditional on government ideology. This net effect is however due to the effects of the single domains of globalization cancelling each other out. While the magnitude of the negative effect of economic globalization increases the more conservative a government is (Panel (b)), Panels (c) and (d) show that the effects of political and social tend to increase from left to right (though the interaction term itself is insignificant).

Figure 2.6: *Marginal effects, interaction of globalization and government ideology, regular employment, 1985–2003*



Note: Graphs depict marginal effect of overall (a), economic (b), political (c) and social globalization (d) conditional on government ideology and the 90 percent confidence interval.

Figure 2.7: *Marginal effects, interaction of globalization and government ideology, atypical employment, 1985–2003*



Note: Graphs depict marginal effect of overall (a), economic (b), political (c) and social globalization (d) conditional on government ideology and the 90 percent confidence interval.

Corroborating our conclusion from Table 2.8 that right wing governments tend to trade off deregulation in the more important sector against an increase in regulation in the smaller sector, Figure 2.7 shows that for the atypical employment sector, for all measures of globalization, right wing governments increase regulation more (or deregulate less) than left wing governments if confronted with increasing globalization.

2.7 Conclusion

In this chapter we have empirically investigated whether globalization exerts a downward pressure on the protection of workers' employment conditions. It is the first contribution to account for the various dimensions of globalization, the economic, the political and the social one, in this field. It is also the first to differentiate between regular and atypical employment.

Using a panel of 28 OECD countries from 1985 to 2003, we test for the impact of globalization in its economic, political and social dimensions on the strictness of employment protection legislation. We reveal that overall globalization lowers employment protection of the regularly employed, but has no significant net effect on that of workers in 'atypical' employment relations. We argue that relative increase in the protection of the economically less important group of short-term workers may serve as symbolic political act by vote-maximizing politicians intending to 'buy' workers' acceptance of labor market liberalization for the regularly employed.

The analysis for the single dimensions of globalization is supportive of this political economy interpretation: We find that it is mainly the economic dimension of globalization, possibly triggering producer's lobbying activities, that lowers employment protection for regularly employed workers, as predicted by international trade models. We also find that political globalization, possibly one of the transmission channels of producer preferences, adds to this downward pressure. However, for workers in atypical employment, the negative effect of economic globalization is outweighed by the effects of international political and social integration, where the latter possibly makes the common

workers aware of the phenomenon of globalization through international travel and worldwide communication, while political globalization acts as transmission channel of workers' preferences.

Furthermore, we find that globalization aggravates the effects of domestic political or economic determinants of labor protection: The deregulative influence of adverse macroeconomic conditions is the larger, the more globalized a country is. This result holds for both sectors of the labor market, with the deregulative effects for the regularly employed enforced by the economic dimension, and for the temporarily employed by all three dimensions. In line with common expectations, we find that right-wing governments decrease protection of the regular labor market sector the stronger, the more the country is integrated into the world market. In contrast, right-wing governments make regulation of the temporary employment sector the stricter, the more the country is globalized in the political dimension. We view the relevance of political globalization in its interplay with local economic and political conditions for increasing the protection of the 'atypical' and economically less important employments as another support for the political economy interpretation of our results, now suggesting that particularly right-wing politicians trade off deregulation of one labor market sector by a stronger regulation of the other.

Overall, this analysis suggests that the economic and societal effects of globalization are not as clear-cut as some public discussions may suggest. The common intuition that globalization is detrimental to the well-being of the dependently employed can only be partly supported. It appears that workers in atypical employment contracts, commonly viewed as more vulnerable as compared to the regularly employed, are not negatively affected by the forces exerted by globalization. Our analysis also reveals that it is rather domestic economic and political conditions that are the main drivers of labor market liberalization, the impact of which is the stronger the more globalized a country is. Furthermore, our interplay analysis also suggests that the process of globalization is used as an argument in the political debate, so that, depending on government ideology, government response either aggravates or counteracts the effects of globalization. Our analysis also reveals that this government response does not necessarily follow traditional ideological lines, contradicting common views and simple

truths. However, to identify the exact mechanism behind this development in greater detail, and to analyze whether these developments continue in a linear fashion beyond 2003, further research is needed.

2.8 Tables

Table 2.9: *Break points of Employment Protection Legislation (EPL) indices*

		Reform description	*EPL overall*	*EPL regular contracts*	*EPL temp. contracts*
Australia	*1996*	Workplace Relations Act 1996 set out factors that Australian Industrial Relations Commission must have regard to when determining whether a termination is unfair	+	+	=
	2004	The scale for employers with 15 or more employees has also increased in March 2004 (the small business exemption to severance pay has been removed, now requiring employers with less than 15 employees to pay).	+	+	=
Austria	*2003*	Employees Income Provision Act eliminated severance paid and integrated into individual saving accounts accessible during unemployment spells	-	-	=
Belgium	*1997*	Restriction on TWA were reduced and FTC were made renewable	-	=	-
	2000	Tightening of rule concerning notice period and compensation in case of unjustified dismissal for blue collar workers	=	=	=
	2002	The maximum total duration of TWA was lengthened for contracts justified by temporary increase in work-load (Dec. 2001)	=	=	=
Canada		No changes			
Czech Republic		No changes			
Denmark	*1995*	Since the mid-1990s the role of TWA has been recognized by social partners and their scope increased	-	=	-
Finland	*1991*	The delay before notice can start was shortened from 2 months (as set in the Act on the Dismissal Procedure) to 1-2 weeks (as set in the Act of Employment Contracts)	-	-	=
	1996	Notice period was halved for workers with tenure less than 1 year	-	-	=
	2001	The new employment contract act came into force reducing notice periods further	-	-	=
France	*1986*	Prior administrative authorization for dismissals for economic reasons was abolished	-	-	=
	1990	The list limiting the circumstances in which the use of FTC and TWA is permissible is restored and the maximum total duration of FTC and TWA was reduced	+	=	+
	2001	Severance pay entitlements were increased	=	+	=
Germany	*1985*	FTC were allowed without specifying an objective reason			
	1993	Notice period for blue collar workers was extended and aligned with that of white collar workers	=	+	=
	1994	TWA legislation was loosened	-	=	-
	1996	The renewal period for FTC and TWA and admissible frequency of renewals were increased	-	=	-
	2002	Maximum total duration of TWA was brought to 24 months	-	=	-
	2004	The limit on the maximum total duration of TWA was lifted. (from 1. Jan 2004)	-	=	-
Greece	*1990*	Notice period or severance pay entitlements were reduced (law 1989) amending law 3198/55 of 1955)	-	-	=
	2003	National General Collective Labour Agreement (2002-2003) changes dismissal rules and raises slightly entitlements to severance pay	-	-	=
	2003	PD 81/2003 changes FTC and TWA	-	=	-
Hungary	*2003*	The amended labour code introduced stricter regulations on renewal of fixed term contracts	+	=	+
Ireland	*2003*	The Protection of Employees act tightened regulation on valid cases for FTC and limited their maximum overall duration to 4 years	+	=	+
	2003	The Redundancy Payments Bill (dismissal laws) raised severance pay entitlements	=	=	=
Italy	*1987*	Fixed term contracts use was widened through collective agreements specifying target groups and employment shares	=	=	=
	1997	Treu package on FTC widened the number of valid cases for the use of FTC	-	=	-
	1998	TWA were permitted	-	=	-
	2000	Reform of TWA 2000 extended the use of TWA and removed the restrictions concerning unskilled workers	-	=	-

Notes: Source: OECD (2004), pp.119-120. The equal sign indicates that the change in a sub-item was not large enough to be visible in the overall EPL index ; '-' ('+') indicates less (more) protection. Empty fields are also empty in the original source.

Break points of Employment Protection Legislation (EPL) indices, continued.

		Reform description	*EPL overall*	*EPL regular contracts*	*EPL temp. contracts*
Japan	*1985*	TWA were permitted for 13 occupations only			
	1996	The use of TWA was extended to 26 occupations	-	=	-
	1999	The use of TWA was extended to all occupations with some exclusions	-	=	-
Korea	*1998*	TWA were liberalized	-	=	-
	1998	Dismissals for managerial reasons are allowed (i.e. redundancy and economic restructuring). Whereas this new law may be used for dismissing a single person for urgent business needs, it was mainly introduced with collective dismissals in mind	-	-	=
Mexico		No changes			
Netherlands	*1999*	The flexibility and security law increased the maximum possible number of FCT and lengthened the maximum total duration of contracts with TWA	-	=	-
	2001	The EU directive on fixed-term work came into effect reducing the maximum total duration of TWA contracts	=	=	=
New Zealand	*2000*	Employment relations act tightened the legislation on individual and collective dismissals	+	+	=
	2000	Employment relations act also tightened the legislation on FTC and TWA	+	=	+
Norway	*1995*	TWA legislation was eased	-	=	-
	2000	TWA legislation was further eased	-	=	-
Poland	*2002*	The new labour code lifted some restrictions in the use of FTC (from 2 renewals permitted to unlimited – until accession)	-	=	-
	2003	A new law tightened regulations on temporary work agencies limiting the cases when TWA contracts are allowed and reducing their maximum total duration	+	=	+
Poland	*2002*	The new labour code lifted some restrictions in the use of FTC (from 2 renewals permitted to unlimited – until accession)	-	=	-
	2003	A new law tightened regulations on temporary work agencies limiting the cases when TWA contracts are allowed and reducing their maximum total duration	+	=	+
Portugal	*1989*	Firing restrictions were eased (dismissals for individual redundancy were authorised)			
	1991	Firing restrictions were eased further (dismissals for unsuitability were authorised)	-	-	=
	1996	A strategic social plan between social partners was agreed to widen the use of FTC and TWA	-	=	-
	2004	New Labour Code came into force in December 2003	-	=	-
Slovak Republic	*2003*	A mew Labour code was approved that relaxed regulations on dismissal of regular contract employees and collective dismissals	-	-	=
	2003	The new Labour code also increased valid cases for FTC, raised the number of possible renewals and the maximum overall duration of FTC	-	=	-
Spain	*1984*	Restrictions for FTC were substantially relaxed			
	1994	Procedural requirements for dismissals for economic reasons were relaxed, notice periods shortened	-	-	=
	1994	Rules governing renewals of FTC were tightened and temporary work agencies permitted	-	=	-
	1997	Maximum compensation for unfair dismissal was reduced and some changes were made to the definition of fair dismissal	-	-	=
	2001	Law 12/2001 tightened the rules governing valid cases for the use of FTC	+	=	+
Sweden	*1993*	TWA were permitted	-	=	-
	1997	FTC were made possible without objective reason	-	=	-
Switzerland		No changes			
Turkey		No changes			
Great Britain	*1985*	The period of service to claim unfair dismissal increased to 2 years			
	2000	Trial period was halved	+	+	=
	2002	Maximum total duration of FTC was reduced to 4 years (from unlimited)	=	=	+
United States		No changes			

Notes: Source: OECD (2004), pp.119-120. The equal sign indicates that the change in a sub-item was not large enough to be visible in the overall EPL index ; '-' ('+') indicates less (more) protection. Empty fields are also empty in the original source.

Table 2.10: *Descriptive statistics and data sources*

Variable	*Obs.*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Definition*	*Source*
Employment protection regular	401	2.19	0.96	0.17	5.00	Index from (0) to (5)	OECD (2004)
Employment protection temporary	401	2.19	1.59	0.25	5.38	Index from (0) to (5)	OECD (2004)
Globalization, overall index	401	73.01	12.04	41.46	93.21	Indicator from (0) to (100)	Dreher (2006)
Economic globalization	401	73.49	12.47	37.75	96.04	Indicator from (0) to (100)	Dreher (2006)
Political globalization	401	79.93	12.95	39.41	99.00	Indicator from (0) to (100)	Dreher (2006)
Social globalization	401	67.86	16.93	19.83	92.04	Indicator from (0) to (100)	Dreher (2006)
Log GDP	401	9.88	0.35	8.54	10.46	National income	World Bank (2009)
Unemployment rate	401	8.43	4.08	1.60	23.90	Share of unemployed in active population	OECD (2009)
Log unemployment spending	401	0.11	0.80	-2.30	1.67	Unemployment spending as share of GDP	OECD (2009)
Union density	342	38.48	21.01	8.20	83.86	Percentage of union members in dependent workforce	Dreher and Gaston (2005)
5-year GDP growth	401	0.11	0.09	-0.16	0.51	(GDP – GDP(-5))/ GDP(-5)	
Left-wing government	401	0.45	0.50	0.00	1.00	Dummy variable.	Beck et al. (2001)
Right-wing government	401	0.26	0.36	-0.57	1.00	Continuous measure	Bjørnskov (2008)

Notes: based on regression sample of Tables 2.1, 2.2 and 2.15 (union density).

Table 2.11: *Globalization and protection of regularly employed, 1985–2003, parsimonious model*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log GDP (-2)	-0.374***	-0.396***	-0.434***	-0.386***	-0.401***
	[3.11]	[3.31]	[3.61]	[3.10]	[3.24]
Globalization, overall (-2)	-0.017***				
	[6.07]				
Economic glob. (-2)		-0.013***	-0.013***		
		[5.62]	[5.99]		
Political glob. (-2)		-0.004**		-0.004**	
		[2.40]		[2.54]	
Social glob. (-2)		-0.003**			-0.006***
		[2.03]			[3.22]
Constant	7.298***	7.740***	7.615***	6.376***	6.599***
	[6.00]	[6.38]	[6.23]	[5.12]	[5.31]
Observations	480	480	480	480	480
Number of countries	28	28	28	28	28
R-squared (within)	0.16	0.18	0.16	0.10	0.11

Notes: Dependent variable is the Employment Protection Index for regularly employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 2.12: *Globalization and protection of atypically employed, 1985–2003, parsimonious model*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log GDP (-2)	0.793**	0.724**	0.804**	0.756**	0.795**
	[2.47]	[2.27]	[2.51]	[2.36]	[2.48]
Globalization, overall (-2)	0.010				
	[1.31]				
Economic glob. (-2)		-0.012**	-0.010*		
		[1.97]	[1.66]		
Political glob. (-2)		0.008*		0.009**	
		[1.77]		[2.01]	
Social glob. (-2)		0.009*			0.008*
		[1.88]			[1.79]
Constant	-6.913**	-5.780*	-5.359	-6.473**	-6.755**
	[2.13]	[1.78]	[1.65]	[2.02]	[2.10]
Observations	480	480	480	480	480
Number of countries	28	28	28	28	28
R-squared (within)	0.24	0.26	0.25	0.25	0.25

Notes: Dependent variable is the Employment Protection Index for atypically employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 2.13: *Globalization and protection of regularly employed, 1985–2003, OECD countries with no communist past*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log GDP (-2)	-0.337	-0.311	-0.741**	-0.873**	-0.887**
	[0.95]	[0.89]	[2.21]	[2.56]	[2.52]
Unemployment rate (-2)	0.002	0.004	0.005	-0.004	-0.002
	[0.30]	[0.68]	[0.75]	[0.67]	[0.29]
Log unemployment spending (-2)	-0.097***	-0.104***	-0.132***	-0.089**	-0.109***
	[2.71]	[2.86]	[3.62]	[2.36]	[2.92]
GDP growth (-2)	0.004	0.005	0.024	0.029	0.028
	[0.21]	[0.27]	[1.35]	[1.58]	[1.48]
Left-wing government (-2)	0.054**	0.055**	0.041*	0.053**	0.044**
	[2.52]	[2.59]	[1.92]	[2.40]	[1.97]
Globalization, overall (-2)	-0.021***				
	[5.40]				
Economic glob. (-2)		-0.014***	-0.013***		
		[5.14]	[4.78]		
Political glob. (-2)		-0.007***		-0.006***	
		[3.61]		[3.05]	
Social glob. (-2)		-0.003			-0.005**
		[1.53]			[2.02]
Constant	6.754**	6.778**	9.867***	10.760***	10.668***
	[2.18]	[2.21]	[3.29]	[3.52]	[3.39]
Observations	370	370	370	370	370
Number of countries	22	22	22	22	22
R-squared (within)	0.25	0.27	0.23	0.20	0.19

Notes: Dependent variable is the Employment Protection Index for regularly employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 2.14: *Globalization and protection of atypically employed, 1985–2003, OECD countries with no communist past*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log GDP (-2)	2.942***	2.987***	3.954***	2.965***	2.925***
	[2.91]	[3.01]	[4.19]	[3.15]	[3.03]
Unemployment rate (-2)	-0.012	0.002	0.002	-0.005	-0.011
	[0.66]	[0.11]	[0.12]	[0.30]	[0.62]
Log unemployment spending (-2)	-0.204**	-0.273***	-0.222**	-0.245**	-0.203**
	[1.99]	[2.63]	[2.17]	[2.36]	[1.99]
GDP growth (-2)	-0.112**	-0.110**	-0.155***	-0.115**	-0.109**
	[2.11]	[2.11]	[3.09]	[2.28]	[2.11]
Left-wing government (-2)	0.060	0.042	0.067	0.044	0.064
	[0.99]	[0.70]	[1.11]	[0.71]	[1.06]
Globalization, overall (-2)	0.014				
	[1.28]				
Economic glob. (-2)		-0.018**	-0.019**		
		[2.28]	[2.38]		
Political glob. (-2)		0.012**		0.014**	
		[2.05]		[2.43]	
Social glob. (-2)		0.012*			0.012*
		[1.87]			[1.86]
Constant	-24.723***	-24.759***	-31.873***	-25.097***	-24.349***
	[2.79]	[2.84]	[3.77]	[2.98]	[2.82]
Observations	370	370	370	370	370
Number of countries	22	22	22	22	22
R-squared (within)	0.32	0.34	0.33	0.33	0.32

Notes: Dependent variable is the Employment Protection Index for atypically employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 2.15: *Globalization and protection of regularly employed, 1985–2003, controlling for union density*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log GDP (-2)	-1.168***	-1.198***	-1.647***	-1.969***	-1.740***
	[3.10]	[3.16]	[4.16]	[5.25]	[4.53]
Unemployment rate (-2)	0.008	0.006	0.008	-0.003	0.004
	[1.34]	[1.00]	[1.11]	[0.46]	[0.64]
Log unemployment spending (-2)	-0.049	-0.035	-0.104***	-0.035	-0.067*
	[1.45]	[0.99]	[2.89]	[0.95]	[1.91]
Union density (-2)	-0.019***	-0.020***	-0.015***	-0.019***	-0.020***
	[7.62]	[7.18]	[5.33]	[6.98]	[7.35]
GDP growth (-2)	0.053***	0.055***	0.068***	0.085***	0.077***
	[2.66]	[2.72]	[3.16]	[4.14]	[3.68]
Right-wing govt., continuous (-2)	-0.124***	-0.127***	-0.077**	-0.092***	-0.097***
	[3.86]	[3.93]	[2.32]	[2.76]	[2.88]
Globalization, overall (-2)	-0.030***				
	[7.48]				
Economic glob. (-2)		-0.010***	-0.013***		
		[3.19]	[4.03]		
Political glob. (-2)		-0.011***		-0.010***	
		[5.08]		[4.49]	
Social glob. (-2)		-0.010***			-0.011***
		[4.15]			[4.53]
Constant	15.337***	15.712***	18.496***	21.490***	19.307***
	[4.59]	[4.67]	[5.23]	[6.34]	[5.60]
Observations	342	342	342	342	342
Number of countries	20	20	20	20	20
R-squared (within)	0.39	0.40	0.31	0.32	0.32

Notes: Dependent variable is the Employment Protection Index for regularly employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 2.16: *Globalization and protection of atypically employed, 1985–2003, controlling for union density*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Log GDP (-2)	1.312	1.699	2.208*	1.319	1.450
	[1.15]	[1.50]	[1.97]	[1.24]	[1.32]
Unemployment rate (-2)	-0.006	0.009	0.006	0.001	-0.005
	[0.29]	[0.46]	[0.32]	[0.08]	[0.25]
Log unemployment spending (-2)	-0.168	-0.273**	-0.185*	-0.230**	-0.164
	[1.65]	[2.57]	[1.82]	[2.20]	[1.61]
Union density (-2)	-0.023***	-0.015*	-0.021***	-0.021***	-0.023***
	[3.01]	[1.89]	[2.65]	[2.79]	[2.88]
GDP growth (-2)	-0.034	-0.058	-0.072	-0.037	-0.040
	[0.56]	[0.95]	[1.18]	[0.63]	[0.67]
Right-wing govt., continuous (-2)	0.151	0.182*	0.124	0.172*	0.145
	[1.55]	[1.88]	[1.31]	[1.81]	[1.50]
Globalization, overall (-2)	0.009				
	[0.72]				
Economic glob. (-2)		-0.018*	-0.015*		
		[1.94]	[1.72]		
Political glob. (-2)		0.015**		0.015**	
		[2.45]		[2.40]	
Social glob. (-2)		0.009			0.004
		[1.20]			[0.57]
Constant	-9.284	-13.005	-16.001	-9.996	-10.224
	[0.92]	[1.29]	[1.59]	[1.04]	[1.03]
Observations	342	342	342	342	342
Number of countries	20	20	20	20	20
R-squared (within)	0.35	0.37	0.35	0.36	0.35

Notes: Dependent variable is the Employment Protection Index for atypically employed workers (OECD, 2004), ranging from 0 to 6. OLS estimation with country and year fixed effects (not reported). Globalization is measured on a scale ranging from 0 to 100 (Dreher, 2006). Absolute value of t-statistics in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Chapter 3

The Impact of Political Leaders' Profession and Education on Reforms

The Impact of Political Leaders' Profession and Education on Reforms[1]

3.1 Introduction

Market-liberalizing reforms have been shown to boost economic growth by increasing trade, reducing prices and improving productivity, as well as attracting foreign direct investment.[2] Nevertheless, some countries are more reluctant than others to implement such reforms. The economics literature provides various insights as to why this might be the case. For example, reform deadlocks can be explained by the uncertainty over the distribution of gains and losses from policy changes (Fernandez and Rodrik, 1991), or the fear of policy persistence (Coate and Morris, 1999).[3]

In modern democracies, elected politicians decide on policies and reform-strategies. When it comes to designing reform policy, in particular, politicians' education and professional experience is likely to be important. As Kotsogiannis and Schwager (2006, p. 485) argue, "the implementation of new and unknown policies is more demanding than running 'business as usual' since it requires imaginative leadership on the part of a governor, rather than operational routine." Politicians with a certain educational or professional background may be more likely than others to demonstrate such kind of leadership. These politicians thus may have an advantage in fostering reforms. According to Rajan (2004), for example, the "gains from reform are never as clear to the wider public as they are to economists." Hence, reforms might be delayed due to a lack of understanding and education. Some background education in economics could be advantageous for politicians in implementing reforms as they are more likely

[1] This chapter is based on Dreher et al. (2009).

[2] See Wacziarg and Welch (2008), Megginson and Netter (2001) and Henry (2003). See also McMillan (2004) and de Haan and Sturm (2000). De Haan et al. (2006) provide an excellent survey on the relationship between market-oriented institutions and economic growth.

[3] "For the initiator [of a new system] has the enmity of all who would profit by the preservation of the old institution and merely lukewarm defenders in those who would gain by the new ones." Machiavelli, The Prince, 1513, cited in Feinberg (2006). Even if a policy is pareto dominating in the short-run, the fear of its persistence might lead to this policy failure.

to distinguish good from bad advice and might be more able to resist the pressure of lobbying groups preferring the status quo. This knowledge might bring them into a better bargaining position as well. They might also have an advantage in communicating the consequences of reforms to the public and the parliament, thus decreasing uncertainty and overcoming the deadlock.

Recently, there is a growing literature connecting personal traits of politicians with actual policy outcomes. Jones and Olken (2005) find that unpredictable changes in a country's leadership due to the incumbent's death can trigger changes in gross domestic product (GDP) growth. They show that who is the head of government matters for economic growth.[4] Pande (2003), Chattopadhyay and Duflo (2004), and Washington (2006) study the relationship between politicians' peer groups and policies that either benefit the respective group or are in line with the peer groups' views.[5] The impact of education and profession on policy has also been in the focus of previous literature. Göhlmann and Vaubel (2007) provide recent empirical evidence. Their results show that education and profession of the central bank's governing council members matter for the effectiveness in controlling inflation.[6] Regarding education of politicians, Duflo (2005) shows that reservation of political power for historically disadvantaged groups and women in India does not come at the expense of the quality of decision making, even though reservation brings to power a group of relatively inexperienced and less educated politicians. Besley et al. (2005), to the contrary, use household survey data from India and find that differences in the performance of Indian village politicians are systematically linked to politicians' education. In particular, education significantly reduces the probability that a politician uses his power opportunistically. This evidence leads a corre-

[4]According to the findings of Jones and Olken (2005), the consequences of unexpected changes in leadership are substantial: Variability of GDP growth increases by 31 percent following a leader's death.

[5]Pande (2003) shows that the reservation of political mandates for members of disadvantaged castes and tribes in India has increased targeted transfers to these groups. According to Chattopadhyay and Duflo (2004), a similar regulation for women in India has led to policies benefiting especially women. Studying voting behavior of US congressmen, Washington (2006) finds that congressmen with daughters are substantially more likely to vote in-line with feminist views.

[6]In a related study, Adolph (2004) shows that personal career ambitions affect the performance of central bankers.

sponding World Bank (2005) report to conclude "that more educated politicians are better" adding to "a growing appreciation among economists that education [of politicians] may be important because of its role in inculcating civic values."

In this study, we go one step further and analyze why it would matter for policy outcomes who is the chief executive of a country. A potentially important channel by which politicians can affect growth rates is on deciding about whether or not to pursue reform-oriented policies. Investigating the link between leading politicians' background and reforms is thus important. Surprisingly, this question has so far not been investigated with respect to heads of national governments. It is this question our analysis deals with.

Specifically, we test the extent to which the educational and professional background of heads of governments is associated with the implementation of reforms. Employing panel data over the period 1970–2002, we present empirical evidence based on a novel data set covering profession and education of more than 500 political leaders prior to entering office from 73 countries. In a nutshell, our results show that reforms are more likely during the tenure of former entrepreneurs. Entrepreneurs belonging to a left-wing party are more successful in inducing reforms than a member of a right-wing party with the same previous profession. Former professional scientists also foster reforms, the more so, the longer they stay in office. To the contrary, there is no robust impact of education on reforms.

We proceed as follows. The next Section describes our method and data. Section 3.3 shows the results and discusses their relation to political-economic theory, while Section 3.4 provides extensions. Finally, Section 3.5 concludes.

3.2 Data and Methodology

We estimate pooled time-series cross-section (panel data) regressions. The data cover the years 1970–2002 and extend to 64 countries.[7] All data are averages

[7]Sample selection is driven by data availability. While data on profession and education are available for 73 countries, we lose the observations for 8 countries due to missing control variables, and drop one country where no single head of government can be identified (Switzerland, which is governed by a federal council comprising seven members of equal rights).

over five years (as the dependent variable is not available on a yearly basis) and the regressions include a dummy for each sub-period. The basic equations take the following form:

$$reform_{it} = \alpha + \beta_1 prof_{it} + \beta_2 educ_{it} + \gamma X_{it} + \eta_t + \epsilon_{it}, \tag{3.1}$$

where $reform_{it}$ represents our measure of reforms (as introduced below), $prof_{it}$ is the vector of professions of the head of government in country i at time t, and $educ_{it}$ represents education. X is the vector of control variables, η_t are fixed period effects, while ϵ_{it} is the disturbance.

The regressions are estimated using various estimators, to test for the robustness of our results. First, we employ feasible generalized least squares (FGLS). This allows estimation in the presence of AR(1) autocorrelation within panels and cross-sectional heteroskedasticity across panels.[8] We also report results using three alternative estimators: pooled OLS with clustered standard errors, the within-groups (country fixed effects) estimator, and the fixed effects estimator including the lagged dependent variable.

In our analysis, we focus on the heads of government and extract information concerning their education and profession. Clearly, chief executives do not rule a country alone. However, they have a prominent position and dominate the political agenda of the government.[9]

Concerning the choice of professions and education to focus on, we slightly adopt the categories by Göhlmann and Vaubel (2007). They distinguish the

[8]The FGLS estimator has been shown to perform efficiently under heteroskedasticity and autocorrelation as compared to standard panel estimators. Note that the FGLS correction for a single AR(1) term is unlikely to cause the standard errors to be flawed as would be the case employing the Parks correction with individual AR(1) terms for each country (Beck and Katz, 1995, p. 637). In all specifications a likelihood ratio test rejects the hypothesis of no AR(1) at conventional levels of significance. The procedure of estimation employed here is standard in the recent literature. See e.g. Kilby (2006). Note, however, that employing the Parks correction with individual AR(1) terms for each country does not change the results.

[9]Chappell et al. (2004) show that the chairman exercises 40 percent to 50 percent of the voting weight in Committee decisions. Of course, the power of the head of state varies by country. Germany's chancellor, for instance, has the constitutional power to set the overall policy direction. In Switzerland, to the contrary, there exists only a formal head of government (the president of the federal council) has no particular power over the stance of economic and fiscal policy. For this reason we exclude Switzerland from the analysis.

following categories with respect to education: economics, business, law, engineering, and other. Regarding profession their categories comprise bankers, insurance executives, businessmen, farmers, lawyers, economic scholars, central bank staff, union leaders, ministerial public servants, other public servants, politicians, and unknown. We initially employed the following professional categories: entrepreneurs, white collar workers, blue collar workers, union executives, economics scientists, other scientists, lawyers, military professionals, politicians, and no or other professions. With respect to education, we distinguish economics, law, politics, natural science, not university, other and unknown education. To reduce complexity (and after testing for the - statistically insignificant - impact of some of the individual categories), we subsumed white and blue collar workers in the category "other profession;" lawyers have been merged into the category "other scientists." Regarding education, the category "other university" also comprises education in law and politics.

Our reasoning for building these categories is as follows: Military leaders are included as they have been quite common in many governments for some time. We do not code the finance sector separately, as we do not expect experience in this sector to make a difference regarding market-oriented reforms (while it obviously does with respect to central bank policies). We presume that entrepreneurs and scientists in economics should foster reform due to their strong economic background. Furthermore, it is likely that union executives impede market liberalizing reforms, while the impact of professional politicians is not obvious a priori. On the one hand, they frequently lack economic knowledge. On the other hand, they are usually better connected with the political basis.

The data for this study are drawn from a wide array of sources. Descriptive statistics, data sources and definitions are shown in the respective tables in Section 3.6 at the end of this chapter. The names and tenure of politicians is taken from numerous publicly available sources. We compared our results with those in Goemans et al. (2009), who provides extensive data and information on individual leaders. When there were multiple leaders in a particular year and country we chose the leader who has been in office for the longest time period within the year. With few exceptions, our data coincide with those

in Goemans et al. (2009).[10] Profession and education of the chief government executives are drawn from publicly available sources, including official government web pages and various lexica. We were able to obtain data for more than 500 chief executives from 73 countries. Clearly, classification sometimes has to rely on judgement to some extent, as some of the sources remain rather vague. We have hence assigned more than one profession to several heads of government if we judged these professions to be important in shaping the politician's mindset. For example, the former British prime Minister John Major worked as an insurance broker and bank employee, but also spent some time working in his father's garden gnome business and has also been unemployed for some time. Hence, Major was put in the categories "white collar" and "other." On the other hand, many chief executives had a long career in politics before becoming heads of the government. We did not include them in the category "professional politician," if they have had substantial professional experience before becoming professional politicians. For example, we put the late Israeli prime minister Yitzhak Rabin into the category "military professional." Rabin served as high-ranked military in the Israeli army, as ambassador to the United States, member of the parliament, and labor minister before becoming Prime Minister. Whether Rabin has to be classified as military professional or professional politician is thus not obvious, but based on the large influence that his military career had on his work as a politician, we opted for military professional. The category "professional politician" is thus reserved for politicians with no additional substantial professional job experience outside of politics.

One possibility that comes immediately to mind is the selection problem. If profession and education of the head of state is non-random, some outside factors could cause both reforms and politicians' background. While Equation 3.1 assumes reforms to be determined by politicians' background, crises or certain economic or social circumstances might affect both the probability of a spe-

[10]The exceptions are Portugal and Romania. For Portugal, Goemans et al. (2009) lists the presidents as leaders. We chose to use the prime ministers instead, as these are responsible for all government policies in Portugal, while the president is head of the army. Concerning Romania, Goemans et al. (2009) switches between listing the prime minister and the president. In line with the Romanian constitution, we consistently focus on presidents. Note that excluding these countries from the analysis does not change the results.

cific type of politician to be elected and the probability of reforms at the same time.[11] As shown in Dreher and Lamla (2007), however, selection of politicians with various backgrounds seems almost idiosyncratic. In Table 3.11 in Section 3.6, we replicate their main analysis.[12] As can be seen, profession and education of politicians is clearly not related to variables that also affect crises and reforms.[13] As only exceptions, GDP per capita growth and civil liberties affect the election probability of certain types of incumbents. We control for these factors in our analysis. Moreover, (lagged) economic crises (as defined in Section 3.4 below) do not significantly affect the incumbent's background in our sample. Arguably, while politicians with different profession and education pursue different policies, voters can usually choose between few candidates running for office only. Hence, they can only choose among a limited, pre-selected number of candidates, and not among the entire set of professions and educations.[14] Thus, while spurious correlation can not be ruled out completely, it is unlikely to be an issue here. Nevertheless, we employ the GMM estimator as suggested by Arellano and Bover (1995) and Blundell and Bond (1998) as test for robustness below. Note that the Sargan test and the Arellano-Bond test clearly do not reject our models, indicating that the estimator is consistent (and endogeneity does not seem to be an issue here). Overall, we are quite confident that reverse causality is not of major importance here. However, we must admit that we can not completely rule out the possibility of reverse causality. We will interpret our results in light of this limitation.

Table 3.1 provides the number of politicians classified in the various groups

[11] In the economics literature there is some evidence that, for instance, poor economic growth reduces the likelihood of being re-elected (e.g. Dreher (2004); Brender and Drazen (2008)).

[12] Note that this estimation is the least conservative regression amongst the results shown in Dreher and Lamla (2007). By using pooled Logit (with clustered standard errors), they make it as easy as possible for any explanatory variable to reveal a significant relationship. When they instead employ fixed effects Logit almost no variable remains statistically significant at conventional levels.

[13] In addition to the variables reported in the Table 3.11, Dreher and Lamla (2007) employ various crises variables (coups, revolutions, strikes), government debt and government fractionalization.

[14] Note that this argument has limitations. While at the end only a very small group of candidates "survives" there might have been many candidates that have "tested the waters" and decided to not run for office.

Table 3.1: *Heads of government, profession and education, 1970–2005, summary*

	number of politicians	*percent left-wing*	*average tenure*
profession			
entrepreneur	11	6	3.00
union executive	9	65	6.33
science economics	20	22	3.70
science other	89	34	4.01
military	87	22	6.44
politician	194	52	4.85
none/ other	103	34	4.56
summary	513	38	4.86
education			
economics	77	37	4.51
natural science	17	52	4.41
other university	255	37	4.91
unknown	59	54	3.26
not university	105	31	5.97
summary	513	38	4.86

Note: The summary line reports the sum of the number of politicians in column 1, the average share of left wing politicians in row 2, and the average tenure of all groups of politicians in the sample in column 3. Percent left-wing refers to a smaller sample as data on political leaning is missing prior to 1975 and after 2002.

of profession and education, and their average tenure. As can be seen, the by far biggest group in the professions category in our sample is professional politicians - people who never worked in any area outside politics prior to becoming head of government. The second largest group comprises people with no prior profession or a profession that is not classified in any other category. The sample encompasses 89 scientists from an area other than economics, 87 former military officers, 20 economists, 11 entrepreneurs and nine union executives. Regarding education, the huge majority of politicians in our sample have university degrees. Average tenure ranges from 3 years for entrepreneurs to 6.4 years for military officers. Table 3.1 also reports the percentage of professions and types of education belonging to left-wing parties. Among military professionals and entrepreneurs, 22 and, respectively, 6 percent are members of left-wing parties. Unsurprisingly, the share of union executives amounts to 65 percent.

Turning to measures of market-liberalizing reforms, recent studies suggest using changes in the economic freedom index as calculated by the Fraser Institute (e.g. Heinemann (2004); Belke et al. (2005); Heckelman and Knack (2008); Dreher and Rupprecht (2007)). The data is available in five year-intervals over the period 1970–2002 for all our 73 sample countries. It covers five broad categories of market-oriented policies and institutions: Size of Government (Area

1), Legal Structure and Security of Property Rights (Area 2), Access to Sound Money (Area 3), Exchange with Foreigners (Area 4), and Regulation of Credit, Labor and Business (Area 5). Each index ranges from 0-10, with 10 showing higher values of economic freedom. Table 3.10 in Section 3.6 contains the individual sub-components.

The average change in the economic freedom index among our sample is an improvement of 0.20. Improvements were largest in Area 3 (with an average of 0.36), while - on average - reforms in Area 1 and Area 5 have been least prevalent (0.13). Table 3.9 in Section 3.6 reports initial values and changes for all areas.

The selection of covariates follows Heckelman and Knack (2008). Heckelman and Knack employ the average annual growth rate in per capita income, linguistic fractionalization, the initial level of civil liberties and the changes thereof, and development aid. Growth is included as it may disrupt special interests blocking reforms.[15] As an alternative hypothesis, reforms might be more likely in times of recession, as voters do not accept reforms when the economy prospers. Linguistic polarization might reflect societies where efficient policy reforms are more difficult to achieve. Civil liberties might increase the probability of reforms but might also reduce it.[16] Development aid is often granted to induce reforms. However, aid induces some degree of moral hazard and might thus lead to less instead of more reforms.[17] In addition, the initial value of the economic freedom index is included to capture potential reversion-to-the-mean effects, as countries with greater economic freedom have less room for improvements than countries with less freedom.

[15]Clearly, growth might be endogenous to economic freedom. For example, de Haan and Sturm (2000) find that economic freedom robustly determines growth. Dawson (2003) also shows that economic freedom fosters growth, while changes in freedom are jointly determined with growth. Following Heckelman and Knack (2008) we include growth to the regressions and test the stability of our results without the growth variable. We alleviate the problem by lagging this variable by one five-year period.

[16]For example, de Haan and Sturm (2003) report that political freedom significantly improves economic freedom. Case study evidence by Devarajan et al. (2001), to the contrary, suggests that autocratic rulers might be more inclined to reform.

[17]See Boockmann and Dreher (2003) and Dreher and Rupprecht (2007) for a discussion and an empirical application to IMF and World Bank lending. Clearly, aid might also concentrate on more reform-oriented countries. Heckelman and Knack (2008) employ instrumental variables to take this potential endogeneity into account. As aid is not the key focus of this paper, we take aid as exogenous regressor.

Data for economic growth rates are taken from the World Bank's World Development Indicators (World Bank, 2006). Linguistic Fractionalization is from Alesina et al. (2003), the index of civil liberties is taken from Freedom House (2002). We transform the original scale of the civil liberties index, so that higher values represent more liberty, on a scale from 1 to 7. The next Section presents the results.

3.3 Results

Table 3.2 presents results where the dummies for profession and education of the chief government politician are included at the same time in addition to the covariates discussed in the previous section. We omit the categories 'no and other profession' and 'no university education'. Hence, the interpretation of all results regarding the impact of a politician's profession or education is relative to these baseline groups.

In column 1 we report the results for the FGLS estimation. As can be seen, market-oriented reforms are significantly more likely with less initial economic freedom, with a coefficient significant at the one percent level. Also, the lagged growth rate has a significantly negative effect on reforms. Hence, countries which suffer from economic downturns are more likely to pass reforms. The coefficient on initial civil liberties is not significantly different from zero. The same applies for the coefficient on the change in civil liberties, linguistic fractionalization and aid. This is contrary to Heckelman and Knack (2008) who find reforms to be significantly more likely with increasing civil liberties and less aid.[18] The covariates are, however, jointly significant at the one percent level in all our regressions.

Concerning our specific research question our results reveal that profession and education of politicians indeed matter. The dummies are jointly significant at the one percent level. Turning to the individual impact, it can be seen from column 1 that reforms are significantly more likely when the incumbent has an entrepreneurial or scientific background compared to politicians with 'no

[18]However, many countries in our sample did not receive any aid during the period under study. The difference to Heckelman and Knack (2008) is thus not surprising.

Table 3.2: *Reforms, Profession, and Education, 1970–2002, 64 countries*

	(1)	*(2)*	*(3)*	*(4)*
Economic Freedom, intitial	-0.130***	-0.128***		
	(6.37)	(4.47)		
Lagged dependent variable				-0.144**
				(2.48)
Growth p.c. (t-1)	-0.028***	-0.022*	-0.059***	-0.067***
	(3.60)	(1.73)	(3.80)	(3.51)
Linguistic fractionalization	0.007	0.019		
	(0.09)	(0.31)		
Civil liberties, initial	0.020	0.027*		
	(1.55)	(1.77)		
Civil liberties, change	-0.006	-0.027	-0.050	-0.104
	(0.18)	(0.48)	(0.89)	(1.58)
Aid (percent of GDP)	-0.002	0.004	0.029	0.002
	(0.24)	(0.58)	(2.29)**	(0.12)
Profession				
entrepreneur	1.058***	0.814**	0.846**	0.750
	(3.36)	(2.48)	(2.05)	(1.42)
union executive	-0.143	-0.116	-0.180	-0.117
	(1.78)*	(1.05)	(1.30)	(0.63)
science economics	-0.084	-0.056	0.002	-0.022
	(0.56)	(0.40)	(0.01)	(0.08)
science other	0.220***	0.209**	0.417***	0.427***
	(3.54)	(2.32)	(3.09)	(2.96)
military	0.146*	0.067	0.146	0.205
	(1.86)	(0.59)	(0.78)	(0.88)
politician	0.061	0.035	0.051	0.126
	(1.13)	(0.48)	(0.39)	(0.89)
Education				
economics	0.267***	0.223**	0.119	-0.005
	(3.42)	(2.09)	(0.67)	(0.03)
natural science	0.279**	0.082	-0.114	-0.100
	(2.03)	(0.39)	(0.44)	(0.37)
other university	0.035	0.007	-0.109	-0.154
	(0.51)	(0.07)	(0.63)	(0.86)
unknown	0.115	-0.044	-0.089	0.014
	(0.98)	(0.22)	(0.37)	(0.05)
Method	*FGLS*	*pooled OLS*	*fixed effects*	*fixed effects*
Number of observations	342	342	342	282
R-squared		0.26	0.30	0.34
Joint sign. (Prob>chi2)	0.00	0.00	0.00	0.00

*Absolute value of z statistics in parentheses. * significant at 10%, ** significant at 5%. *** significant at 1% level. 'Economic Freedom, intitial' gives the level of economic freedom in 1970. 'Lagged dependent variable' gives the change in economic freedom between* $t-2 and t-1$.

and other profession'. In this specification, also former military leaders foster reforms, while the tenure of former union executives seems to be associated with fewer reforms (at the ten percent level of significance). However, as will be discussed in the paragraphs below, these results are not robust to the different methods of estimation. Regarding education, reform activity is higher when politicians with degrees in economics and natural science are in office. The interpretation of these results is straightforward: Entrepreneurs are likely to seek for efficiency and have a proven record of experience in leading a company. Moreover, due to the high correlation between being entrepreneur and having business education they have basic knowledge of economic principles. Hence, it is a reasonable finding that during their tenure, reform activity is higher than during the tenure of politicians with no or other profession.[19] Similar reasoning applies to professional and educational background in science. Such experience provides in general some problem solving skills enabling the politician (to some extent) to infer the right choices. Regarding education, economic training is associated with a higher chance for market liberalizing reform. Again this fits in the context of previous research, as trained economists are more rational and less emotional in taking economic decisions.[20]

In column 2 we estimate the model employing pooled OLS with standard errors clustered at the country level.[21] Regarding education and profession, the impact of former military leaders, union executives, and natural science education is no longer significant at conventional levels, while the other results are in line with those reported in column 1. Regarding our control variables, initial civil liberties are now significant at the ten percent level, with a positive coefficient.

In columns 3 and 4 we include country fixed effects (and thus have to omit variables without time series variation).[22] In column 4 we additionally include

[19]However, our results for entrepreneurs have to be handled with care, as there are only eleven observations for this group in our sample.

[20]See, e.g., Frey and Meier (2003) and Rubinstein (2006).

[21]Note that we also estimated the equation with Newey-West corrected standard errors. The results are not affected.

[22]Note that the standard errors are again clustered at the country level.

the lagged dependent variable to control for autocorrelation.[23] As can be seen from column 3, our results regarding the positive significant relationship between entrepreneurial and science profession and market liberalizing reforms are unchanged. The results also show, however, that the association between reforms and economics education vanishes. When including the lagged dependent variable, the impact of former entrepreneurs is marginally insignificant.[24] Overall, while part of our results are completely robust to the choice of method, some are not. In particular, the effect of education clearly depends on the choice of the estimator.

Previous research suggests that policy outcomes also depend on the time a politician spent in office. For example, Roubini and Sachs (1989) suggest that there is a tendency towards larger deficits in countries characterized by a short average tenure of government. They argue that budget reductions require political consensus which is harder to achieve by weaker governments, which can (inter alia) be proxied by expected tenure of office. We thus augment the set of regressors by a variable measuring the time a political leader has spent in office. Furthermore, we include an interaction term between profession/education and the time in office.

The results are reported in Table 3.3. In the first column we present results for the FGLS estimation. The results show that the impact of time spent in office is negative and significant at the ten percent level for the baseline group. Interestingly, time in office is indeed relevant for the impact of some types of politicians. According to our results, reforms become more likely with each year a professional economist spends in office. Overall, the impact on reforms becomes positive when economists stay in office for at least five and a half years. The impact of other scientists also depends on time in office. According to the estimates, the impact of other scientists is positive from the first year, and increases by 0.04 points with each additional year in office.

[23]The within-groups estimator is biased and inconsistent with the inclusion of the lagged dependent variable in a short panel (Nickell, 1981). We test for the robustness of our results employing a system GMM estimator below. Our results are not affected.

[24]The marginal insignificance is due to the substantial loss of observations rather than due to controlling for the lagged dependent variable per se. When excluding the lagged dependent variable while restricting the regression to the same sample, the results are unchanged.

Table 3.3: *Reforms, Profession, Education, and time in office, 1970–2002, 64 countries*

	(1)		*(2)*		*(3)*		*(4)*	
	linear term	*interaction with time in office*	*linear term*	*interaction with time in office*	*linear term*	*interaction with time in office*	*linear term*	*interaction with time in office*
Economic Freedom, intitial	-0.120***		-0.125***					
	(5.81)		(3.88)					
Lagged dependent variable							-0.186***	
							(3.19)	
Growth p.c. (t-1)	-0.034***		-0.024*		-0.056***		-0.075***	
	(4.28)		(1.92)		(3.93)		(3.89)	
Linguistic fractionalization	0.045		0.047					
	(0.60)		(0.72)					
Civil liberties, initial	0.010		0.017					
	(0.83)		(1.16)					
Civil liberties, change	-0.036		-0.037		-0.077		-0.131**	
	(1.34)		(0.62)		(1.42)		(2.14)	
Aid (percent of GDP)	-0.003		0.004		0.028		0.004	
	(0.38)		(0.52)		(2.23)**		(0.27)	
Time in office	-0.031*		-0.023		-0.018		-0.063**	
	(1.81)		(1.44)		(0.74)		(2.20)	
Profession								
entrepreneur	1.514***	-0.172	0.753	-0.005	0.523	0.041	0.036	0.208
	(3.05)	(1.04)	(0.84)	(0.02)	(0.55)	(0.17)	(0.03)	(0.75)
union executive	-0.188	0.012	-0.281	0.045	-0.500	0.071	-0.227	0.013
	(0.85)	(0.32)	(0.72)	(0.73)	(1.22)	(1.13)	(0.47)	(0.22)
science economics	-1.064***	0.239***	-0.781***	0.199***	-1.044***	0.267***	-1.186***	0.309***
	(4.12)	(4.05)	(3.60)	(4.61)	(4.15)	(6.78)	(5.04)	(6.97)
science other	0.015	0.043	0.061	0.033	0.243	0.048**	0.113	0.071**
	(0.15)	(2.53)**	(0.41)	(1.64)	(1.19)	(2.10)	(0.55)	(2.52)
military	0.041	0.022	0.057	0.008	0.136	-0.003	-0.073	0.055*
	(0.35)	(1.19)	(0.34)	(0.45)	(0.57)	(0.14)	(0.24)	(1.68)
politician	-0.051	0.020	-0.027	0.013	-0.072	0.040**	-0.052	0.032
	(0.61)	(1.35)	(0.24)	(0.93)	(0.45)	(2.34)	(0.34)	(1.49)
Education								
economics	0.245*	0.001	0.202	-0.006	0.161	-0.034	-0.119	0.034
	(1.73)	(0.06)	(1.14)	(0.23)	(0.66)	(1.10)	(0.38)	(0.82)
natural science	0.455	-0.049	0.182	-0.039	0.243	-0.112*	0.057	-0.042
	(1.58)	(0.92)	(0.49)	(0.88)	(0.52)	(1.83)	(0.12)	(0.71)
other university	-0.074	0.014	-0.110	0.013	-0.134	-0.023	-0.301	0.022
	(0.65)	(0.71)	(0.65)	(0.67)	(0.59)	(1.03)	(1.22)	(0.73)
unknown	0.421**	-0.108***	0.211	-0.086***	0.380	-0.147***	0.264	-0.115
	(2.43)	(3.86)	(0.80)	(2.92)	(1.21)	(4.27)	(0.54)	(1.63)
Method	FGLS		pooled OLS		fixed effects		fixed effects	
Number of observations	342		342		342		282	
R-squared			0.30		0.34		0.39	
Joint sign. (Prob>chi2)	0.00		0.00		0.00		0.00	

*Notes: The dependent variable is the change in the economic freedom index ("reforms"). (Absolute) t-statistics in parentheses. In columns 2 - 4, standard errors are clustered at the country level. * denotes significant at 10% level, ** significant at 5% level, *** significant at 1% level. Base categories are "no and other profession" and "no university education." All regressions include a dummy for each five-year-period. "interaction with time in office" reports the coefficients of the interaction term of head of governments' time in office and the respective profession or education. "Economic Freedom, intitial" gives the level of economic freedom in 1970. "Lagged dependent variable" gives the change in economic freedom between* $t-2$ *and* $t-1$.

The remaining columns of Table 3.3 again report results with different methods of estimation. As can be seen, only the correlation between professional economists and reforms is fully robust to the choice of method and all estimates suggest that the effect becomes positive after about four years. However, while the interaction of time in office and other scientists becomes marginally insignificant in pooled OLS model of column 2, it is again significant at the five percent level once fixed country effects are included. Economists and other scientists seem to lack experience when starting their time in office and then significantly improve their performance the more experience they collect as political leaders. These findings are in line with several theoretical arguments brought forth in the literature. Based on Alesina and Drazen (1991), delay of stabilization can be modeled as the outcome of a war of attrition between two parties who disagree over how the adjustment costs of a reform have to be divided. In their recent overview about the different extensions and empirical applications of the 'war of attrition' model, Alesina et al. (2006) highlight the role of political institutions and elections for the outcome of the game. They argue that "...in political systems where the executive has strong powers and cannot be blocked by the opposition easily, the opposition that does not hold the executive faces high costs of fighting the war of attrition ... Then stabilization would occur very soon ..." Alesina et al. (2006) thus clearly underline the importance of executives in the political process. This implies that strong executives may be able to reduce delay in reforms.[25] The power of politicians is likely to depend on their political experience and personal skills, as such skills influence arguments that can be brought forth in negotiations, and enhance the standing of the politician among the electorate. Hence, the longer politicians are in office, the stronger they are.

[25]Spolaore (2004) points out that a dominant executive is not necessarily beneficial in terms of welfare. His model shows that for instance in a political system in which political power is condensed in a very small group, reforms may be inefficiently frequent. This result is basically driven by missing internalization of society's welfare.

Table 3.4: *Reforms and government leaning, 1970–2002, 63 countries*

	(1)		*(2)*		*(3)*		*(4)*	
	linear term	*interaction with left government*	*linear term*	*interaction with left government*	*linear term*	*interaction with left government*	*linear term*	*interaction with left government*
Economic Freedom, intitial	-0.102***		-0.120***					
	(4.44)		(4.66)					
Lagged dependent variable							-0.168***	
							(2.70)	
Growth p.c. (t-1)	-0.026***		-0.019		-0.059***		-0.063***	
	(3.02)		(1.21)		(3.39)		(4.08)	
Linguistic fractionalization	0.037		0.058					
	(0.50)		(0.91)					
Civil liberties, initial	0.019		0.022					
	(1.39)		(1.50)					
Civil liberties, change	0.004		-0.040		-0.076		-0.105	
	(0.12)		(0.64)		(1.27)		(1.47)	
Aid (percent of GDP)	0.002		-0.000		0.030**		0.007	
	(0.28)		(0.06)		(2.16)		(0.44)	
Left government	-0.128		-0.045		0.122		-0.084	
	(0.88)		(0.30)		(0.41)		(0.24)	
Profession								
entrepreneur	0.926***	2.995*	0.852**	2.934***	0.889**	3.760***	0.743	4.175***
	(3.24)	(1.78)	(2.55)	(4.74)	(2.13)	(4.45)	(1.30)	(5.04)
union executive	-0.194	0.065	-0.179	0.183	-0.066	-0.096	-0.004	-0.235
	(1.14)	(0.33)	(1.10)	(0.86)	(0.37)	(0.38)	(0.01)	(0.69)
science economics	-0.214	0.505	-0.077	0.311	-0.037	0.378	-0.097	0.255
	(1.22)	(1.43)	(0.45)	(1.05)	(0.18)	(0.94)	(0.36)	(0.51)
science other	0.206**	-0.159	0.310***	-0.203	0.618***	-0.319	0.645***	-0.427
	(2.33)	(1.01)	(2.99)	(1.15)	(3.74)	(1.06)	(3.69)	(1.27)
military	0.144	0.177	0.130	-0.004	0.249	-0.321	0.263	-0.170
	(1.51)	(1.11)	(0.99)	(0.02)	(1.24)	(1.00)	(1.07)	(0.39)
politician	0.028	0.053	0.052	0.028	0.055	0.175	0.089	0.125
	(0.40)	(0.38)	(0.65)	(0.20)	(0.32)	(0.62)	(0.49)	(0.35)
Education								
economics	0.234**	0.111	0.223*	0.089	0.176	-0.020	-0.063	0.376
	(2.31)	(0.73)	(1.76)	(0.52)	(1.04)	(0.06)	(0.29)	(0.96)
natural science	0.418**	-0.094	0.319	-0.309	0.125	-0.576	0.032	-0.189
	(2.42)	(0.40)	(1.37)	(1.41)	(0.37)	(1.28)	(0.11)	(0.45)
other university	-0.006	0.261*	-0.025	0.166	-0.094	-0.097	-0.223	0.250
	(0.08)	(1.72)	(0.21)	(0.90)	(0.54)	(0.27)	(1.09)	(0.65)
unknown	0.242	-0.079	0.184	-0.327	0.281	-0.845	-0.052	0.099
	(1.38)	(0.30)	(0.50)	(0.64)	(0.63)	(1.16)	(0.11)	(0.15)
Method	FGLS		pooled OLS		fixed effects		fixed effects	
Number of observations	335		335		335		276	
R-squared			0.27		0.33		0.36	
Joint sign. (Prob chi2)	0		0		0		0	

*Notes: The dependent variable is the change in the economic freedom index ("reforms"). (Absolute) t-statistics in parentheses. In columns 2 - 4, standard errors are clustered at the country level. * denotes significant at 10% level, ** significant at 5% level, *** significant at 1% level. Base categories are "no and other profession" and "no university education." All regressions include a dummy for each five-year-period. "interaction with left government" reports the coefficient of the interaction term of left-wing governments and the respective profession or education. "Economic Freedom, intitial" gives the level of economic freedom in 1970. "Lagged dependent variable" gives the change in economic freedom between* $t-2$ *and* $t-1$.

Table 3.4 tests whether controlling for the political leaning of the party of a head of government influences our results. We add a dummy that is one if the chief executive party is left-wing, and zero otherwise, to our basic specification, and interact the dummy for government leaning with the dummies for education/profession.[26] Again, we report results employing four different techniques of estimation.

As can be seen, there is no significant impact of left-wing party affiliation on reforms for our baseline group. However, according to all regressions, left-wing politicians with a professional background as entrepreneurs increase the probability of reform as compared to the base category of right-wing politicians with no or other profession/education. Interestingly, the coefficient of the interaction between left-wing parties and entrepreneurs is also substantially greater in magnitude than the linear coefficient of the entrepreneur dummy. This implies that left-wing entrepreneurs may be more reform-oriented than right-wing ones. The literature provides a ready explanation for this finding: Market-liberal reforms are typically the domain of center and right-wing parties. Cukierman and Tommasi (1998) suggest that political announcements and reform proposals are more likely to be implemented when they are formulated by an incumbent who is not expected to follow an ideology that is compatible with that specific reform.[27]

Finally, Table 3.5 replicates the basic analysis for area-specific reforms. To keep the results tractable, we only report results using the fixed effects estima-

[26] Party orientation is provided by Beck et al. (2001) and is identified with respect to economic policy. Right-wing parties are those that are described as conservative, Christian democratic, or right-wing in the party name, program, or orientation. Left-wing parties are those identified as communist, socialist, social democratic, or left-wing. See also Bjørnskov (2005, 2008).

[27] They argue that policymakers cannot always credibly communicate that a proposed policy is beneficial for society. This is due to the fact that there may be the perception of partisan bias in the reform proposal, which leads to the non-adoption of a socially optimal policy. A policy proposal that has a certain ideological flavor and is proposed by a policymaker on the other side of the range of political positions is perceived as being more likely to be optimal. This hypothesis has also found empirical support. Tavares (2004) finds that left-wing governments tend to reduce a country's deficit by raising tax revenues while right-wing governments rely mostly on spending cuts. Hence, according to the theoretical argument, cabinets can signal commitment by undertaking fiscal reforms in ways that are not favored by their constituencies. According to Tavares (2004), left-wing governments indeed gain credibility when they cut spending while right-wing governments become more credible when they increase tax revenues.

Table 3.5: *Areas of Reform, Profession, and Education, 1970–2002, 64 countries*

	(1) *Government size*	*(2)* *Legal Structure*	*(3)* *Money*	*(4)* *Trade*	*(5)* *Regulation*
Growth p.c. (t-1)	-0.062**	-0.057	-0.031	-0.068**	-0.050***
	(2.19)	(1.65)	(0.79)	(2.45)	(2.90)
Civil liberties, change	-0.011	0.076	-0.386**	0.019	-0.035
	(0.14)	(0.63)	(2.51)	(0.20)	(0.65)
Aid (percent of GDP)	0.036	0.010	0.153***	-0.003	-0.016
	(1.61)	(0.32)	(5.54)	(0.12)	(1.14)
Profession					
entrepreneur	1.227**	0.214	2.276*	-0.447	0.893*
	(2.14)	(0.46)	(1.82)	(1.31)	(1.72)
union executive	-0.167	-0.049	-0.840	0.289	0.047
	(0.58)	(0.19)	(1.62)	(1.29)	(0.22)
science economics	-0.258	0.645*	-0.102	-0.020	-0.330*
	(0.69)	(1.80)	(0.15)	(0.07)	(1.77)
science other	0.307	0.230	1.000**	0.117	0.180
	(1.57)	(0.78)	(2.16)	(0.58)	(1.52)
military	0.175	0.651*	-0.109	-0.124	0.017
	(0.79)	(1.76)	(0.17)	(0.48)	(0.11)
politician	0.219	0.272	-0.558	0.305	0.072
	(1.05)	(0.91)	(1.36)	(1.31)	(0.56)
Education					
economics	0.073	0.256	0.001	-0.125	0.029
	(0.28)	(0.77)	(0.00)	(0.68)	(0.15)
natural science	-0.021	0.074	-0.531	-0.408**	0.133
	(0.06)	(0.28)	(0.67)	(2.16)	(0.48)
other university	-0.101	0.072	-0.329	-0.139	-0.139
	(0.47)	(0.27)	(0.62)	(0.91)	(0.80)
unknown	-0.445	0.378	-0.043	-0.274	-0.581
	(1.18)	(0.96)	(0.07)	(1.00)	(2.15)**
Number of observations	350	333	351	346	331
R-squared	0.26	0.20	0.22	0.18	0.32

*Notes: The dependent variable is the change in the respective area of the economic freedom index ("reforms"). Standard errors are clustered at the country level, * denotes significant at 10% level ** significant at 5% level, *** significant at 1% level. Base categories are "no and other profession" and "no university education." All regressions include a dummy for each country and five-year-period.*

tor (clustering standard errors at the country level). The breakdown allows us to analyze which areas are associated with a specific profession or education. The results show that reforms of government size, access to sound money and regulations of credit, labor and business are associated with the tenure of former entrepreneurs. As entrepreneurs are aware of the impediments of running a business it makes sense that our results suggest that they concentrate on reforms with respect to regulation and the financial system. When economics scientists hold office, reforms regarding the legal structure are more likely, while reforming activity concerning the regulations of credit, labor and business is lower. During the tenure of other scientists access to sound money is improved. Surprisingly, the legal structure is improved when military professionals are the head of government. Turning to education, a background in natural science correlates negatively with reforms regarding free trade.

3.4 Further Discussion

One difficulty with the analysis so far is that the perception among the majority of the economics profession of what sound economic policy actually is did change substantially since the 1970s. The impact of education on market-liberal reforms might thus change over time, and the same is true with respect to professional background. Ideally, we would want to control for the school of thought according to which the respective politician has been educated. However, we lack the data for such analysis. In order to check the robustness of our results with respect to changing views over time we split the sample along the time dimension. In Table 3.6 we report results separated for the periods before 1991 (column 1) and after 1990 (column 2).[28] According to the results, reforms are more likely to occur during the time in office of former entrepreneurs in both sample periods, although their impact is substantially greater in the earlier period as compared to the later one. The coefficient of 'other' scientists is positive in both periods, but marginally insignificant. During the tenure of a leader with economic education reforms are less likely after 1990, at the five percent level of

[28]This and the estimations in columns 5 and 6 of Table 3.6 also checks for the robustness of our results to the exclusion of post-communist transition countries.

Table 3.6: *Reforms, Profession, and Education, sub-samples, 1970–2002*

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Growth p.c. (t-1)	-0.045	-0.066)***	-0.042	-0.063***	-0.052***	-0.026
	(1.01)	(3.22)	(1.67)	(3.27)	(3.38)	(0.72)
Civil liberties, change	-0.051	-0.126	0.003	-0.093	-0.066	0.010
	(0.56)	(1.48)	(0.02)	(1.56)	(0.71)	(0.17)
Aid (percent of GDP)	0.048	-0.013	0.326***	0.023	0.040***	0.046
	(0.86)	(0.94)	(3.03)	(1.70)*	(3.30)	(1.14)
Profession						
entrepreneur	2.531*	0.762**	1.006***	0.686	0.797**	1.630***
	(1.88)	(2.02)	(2.91)	(0.60)	(2.49)	(3.09)
union executive	-0.450	-0.200	-0.190	0.325	-0.028	0.356
	(0.99)	(0.70)	(1.83)*	(0.69)	(0.30)	(0.54)
science economics	-0.228	0.057	0.207	-0.241	0.096	-0.459
	(0.75)	(0.18)	(0.68)	(0.93)	(0.33)	(1.31)
science other	0.438	0.364	0.282**	0.568**	0.364**	-0.222
	(1.13)	(1.48)	(2.38)	(2.44)	(2.27)	(0.60)
military	0.160	-0.005	-0.105	0.179	0.273	-0.152
	(0.55)	(0.01)	(0.53)	(0.65)	(1.45)	(0.46)
politician	0.083	-0.051	0.253	-0.006	0.299**	-0.154
	(0.24)	(0.24)	(1.65)	(0.02)	(2.55)	(0.50)
Education						
economics	0.370	-0.693**	-0.051	0.158	0.034	0.180
	(1.19)	(2.37)	(0.33)	(0.46)	(0.22)	(0.37)
natural science	-0.176	-0.606	-0.014	-0.316	-0.031	0.526
	(0.35)	(1.12)	(0.08)	(0.53)	(0.16)	(0.70)
other university	0.037	-0.511*	-0.318*	-0.006	-0.060	-0.157
	(0.10)	(1.73)	(1.98)	(0.02)	(0.33)	(0.42)
unknown	0.467	-0.866*	-0.088	-0.074	0.110	-1.144
	(0.91)	(1.86)	(0.34)	(0.22)	(0.51)	(1.51)
	<1991	>1990	OECD	w/o OECD	free	unfree
Number of observations	156	186	140	202	215	127
Number of countries	57	64	26	38	54	39
R-squared	0.22	0.43	0.48	0.30	0.50	0.30

*Notes: The dependent variable is the change in the respective area of the economic freedom index ("reforms"). Standard errors are clustered at the country level, * denotes significant at 10% level ** significant at 5% level, *** significant at 1% level. Base categories are "no and other profession" and "no university education." All regressions include a dummy for each country and five-year-period.*

significance.

Furthermore, Table 3.6 reports tests for the robustness of our results with respect to the choice of countries, by separating the sample according to OECD membership (columns 3 and 4), and respectively, the initial level of economic freedom (columns 5 and 6).[29] Our major results remain rather unaffected - reforms are significantly more likely when the head of government has work experience as entrepreneur or scientist (except the sample excluding OECD countries reported in column 4, where the impact of entrepreneurs is no longer significant at conventional levels).

[29] As cut-off we choose the sample median of economic freedom (5.85).

As additional test for robustness we employ the GMM estimator as suggested by Arellano and Bover (1995) and Blundell and Bond (1998). We present results employing the two-step estimator implemented by Roodman (2005) in Stata, including the finite sample correction by Windmeijer (2005). As before, we include time dummies in the regression. We report results of the Sargan-Hansen test on the validity of the instruments (amounting to a test for the exogeneity of the covariates), and the Arellano-Bond test of second order autocorrelation, which must be absent in order for the estimator to be consistent.

Column 1 of Table 3.7 reports the results employing the GMM estimator. As can be seen, the results mirror those reported above, while the lagged dependent variable is not significant at conventional levels.

Finally, we test for the influence of adding further control variables to the analysis. Specifically, we test for the impact of currency crises to control for the effect of countries that experienced serious economic crises, which are likely to trigger reforms. Our index of currency crises is based on the rate of change of the nominal exchange rate and the level of international currency reserves (as calculated in Dreher (2006)).

According to Drazen and Grilli (1993) and Hsieh (2000), crises which increase the welfare loss of delaying stabilization reduce the probability of such reform delay. Following Dreher (2006) we measure political instability by the first principal component of the number of assassinations, strikes, guerilla warfare, major crises, riots, and revolutions in a particular country and year, and the number of successful coups d'état (taken from Banks (1999)).

Another aspect that has to be taken into account is the effect of different political systems on reform activity. Proportional political systems are more likely to lead to short lived governments and coalition governments than majoritarian ones, which typically lead to one party governments. Alesina and Tabellini (1990) show that greater uncertainty regarding re-election leads governments to discount the future more heavily. Consequently, reforms requiring actions with short-term costs exceeding short-term benefits become less likely to be implemented. Empirically, this argument is supported by Grilli et al. (1991), who find that the average durability of a government has a negative effect on debt accumulation. Moreover, Spolaore (1993) shows in a war-of-attrition model that the

Table 3.7: *Reforms, Profession, and Education, further variables, 1970–2002*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Economic Freedom, intitial	-0.093**							
	(2.57)							
Growth p.c. (t-1)	-0.048**	-0.058***	-0.057***	-0.033*	-0.059***	-0.057***	-0.059***	-0.025
	(2.48)	(3.75)	(3.46)	(1.68)	(3.58)	(3.66)	(3.48)	(1.05)
Linguistic fractionalization	-0.076							
	(0.71)							
Civil liberties, initial	0.010							
	(0.59)							
Civil liberties, change	-0.019	-0.050	-0.051	-0.059	-0.049	-0.046	-0.048	-0.060
	(0.29)	(0.90)	(0.84)	(1.04)	(0.87)	(0.84)	(0.85)	(0.86)
Aid (percent of GDP)	0.003	0.029**	0.027	0.034***	0.041	0.030**	0.029**	0.020
	(0.44)	(2.29)	(0.98)	(3.10)	(1.65)	(2.39)	(2.31)	(1.06)
Lagged dependent variable	0.015							
	(0.22)							
Profession								
entrepreneur	0.839**	0.849**	0.765	0.878**	0.846**	0.847**	0.841**	0.799*
	(2.24)	(2.06)	(1.63)	(2.30)	(2.00)	(2.06)	(2.01)	(1.78)
union executive	-0.085	-0.184	-0.166	-0.194*	-0.157	-0.186	-0.180	-0.165
	(0.67)	(1.26)	(1.22)	(1.68)	(1.08)	(1.31)	(1.27)	(1.36)
science economics	0.144	-0.008	0.115	-0.133	0.016	0.023	0.029	-0.031
	(0.94)	(0.04)	(0.46)	(0.67)	(0.07)	(0.10)	(0.13)	(0.12)
science other	0.300**	0.414***	0.394***	0.505***	0.432***	0.400***	0.434***	0.490***
	(2.64)	(2.97)	(3.00)	(3.61)	(3.17)	(3.05)	(3.05)	(3.48)
military	0.038	0.137	0.011	0.208	0.158	0.156	0.162	0.153
	(0.22)	(0.71)	(0.05)	(1.15)	(0.86)	(0.84)	(0.84)	(0.74)
politician	0.069	0.046	0.096	0.136	0.059	0.045	0.067	0.207
	(0.75)	(0.33)	(0.73)	(1.03)	(0.46)	(0.35)	(0.49)	(1.42)
Education								
economics	0.015	0.129	0.086	0.139	0.106	0.115	0.125	0.153
	(0.09)	(0.71)	(0.46)	(0.99)	(0.59)	(0.66)	(0.67)	(1.12)
natural science	-0.123	-0.114	-0.052	-0.158	-0.122	-0.120	-0.118	-0.113
	(0.40)	(0.44)	(0.21)	(0.65)	(0.48)	(0.47)	(0.45)	(0.49)
other university	-0.141	-0.106	-0.129	-0.131	-0.118	-0.101	-0.122	-0.119
	(1.05)	(0.61)	(0.71)	(0.91)	(0.67)	(0.60)	(0.69)	(0.84)
unknown	-0.067	-0.085	-0.182	0.010	-0.083	-0.051	-0.083	0.020
	(0.23)	(0.35)	(0.66)	(0.05)	(0.35)	(0.21)	(0.32)	(0.08)
Additional variables								
Instability		0.013						0.021
		(0.13)						(0.17)
Government fractionalization			0.074					0.190
			(0.24)					(0.57)
Currency crises, dummy				0.280**				0.230*
				(2.52)				(1.98)
Coalition government, dummy					0.030			-0.020
					(0.24)			(0.14)
Direct presidential, dummy						0.274*		0.414**
						(1.84)		(2.19)
Veto players drop (percent)							-0.055	-0.132
							(0.19)	(0.50)
Method	*GMM*	*Fixed eff.*	*Fixed eff.*	*Fixed eff.*	*Fixed eff.*	*Fixed eff.*	*Fixed eff.*	*Fixed eff.*
Number of observations	282	341	313	326	338	342	339	296
Number of countries		64	64	62	64	64	64	61
R-squared		0.30	0.30	0.32	0.29	0.30	0.29	0.33
Arellano-Bond test (Pr > z)	0.51							
Sargan-Hansen test (Prob > chi2)	0.63							

*Notes: The dependent variable is the change in the respective area of the economic freedom index ("reforms"). Standard errors are clustered at the country level, * denotes significant at 10% level ** significant at 5% level, *** significant at 1% level. Base categories are "no and other profession" and "no university education." All regressions include a dummy for each country and five-year-period.*

delay in the adoption of a reform increases with the number of parties in a coalition government. Empirical support for this argument is provided in de Haan et al. (1999), showing that the number of parties in the government affects the growth rate of public debt.[30] As the growth rate of debt is most likely linked to some change in policies, this suggests that it is easier to conduct such policy changes when the government is less fractionalized. We thus also include variables that proxy for political systems and constellations. We employ a dummy that is one if the current government is a coalition of at least two parties, and zero otherwise. We further include a dummy for direct presidential systems, and the percentage of veto players that drop. The data on political systems and constellations are taken from Beck et al. (2001).

The remaining columns of Table 3.7 show the additional variables. As can be seen, two of the additional variables are significant at conventional levels. At the five percent level reforms are more likely at times of crises. This is in line with the theoretical model of Drazen and Grilli (1993) and the empirical findings of Drazen and Easterly (2001). The dummy for direct presidential is positive and significant, suggesting that reforms are more likely in presidential systems. Note, however, that this variable varies rarely over time, so the fixed effects estimate relies on few observations. Turning to the impact of profession and education, our main results are unchanged: reforms are significantly more likely during the tenure of former entrepreneurs and other scientists. The exception is column 3, where the impact of former entrepreneurs is marginally insignificant when the (insignificant) government fractionalization variable is introduced. However, the coefficient is again significant at the ten percent level when all additional control variables are included at the same time (column 8).

3.5 Conclusion

In this chapter, we have analyzed whether politicians' education and profession matters for the introduction of market-liberal reforms. Employing panel data over the period 1970–2002, we presented empirical evidence based on a novel

[30] See also Roubini and Sachs (1989), who find that the size of government depends on political power dispersion in parliament.

data set covering profession and education of over 500 political leaders from 73 countries prior to entering office.

Overall, our results show that education and professional background of politicians are associated with the implementation of market liberalizing reforms. According to our results, reforms are more likely to occur if the head of government has been an entrepreneur before entering into politics. Personal capabilities required to manage a company thus seem to be advantageous in promoting economic reform. Moreover, during the tenure of former professional scientists reforms are more likely, while there is no robust impact of politicians' education. We provide evidence that the time in office and political leaning of the incumbent's party matter for the overall effect of some politicians. Specifically, reforms are more likely the longer former economists stay in office. It seems that economists have to get familiar with their new position before they can successfully organize political support for policy reforms. The tenure of an entrepreneur belonging to a left-wing party is associated with higher reform activity than the tenure of a member of a right-wing party with the same previous profession. This finding supports Cukierman and Tommasi (1998), who argue that reforms are easier to implement for politicians that are not suspected to act for ideological reasons.

Arguably, selection of politicians with various backgrounds might also be driven by the need to reform, giving rise to potential endogeneity. However, as Dreher and Lamla (2007) show, profession and education of politicians is almost idiosyncratic. While politicians with different profession and education pursue different policies, voters can usually choose between few candidates running for office only. They can thus not freely select a candidate with a certain profession and education, but only between profession and education of few opponents. Thus, while reversed causality can not be ruled out completely, it is unlikely to be important here.

In summary, our analysis confirms that the personal background of incumbents may be important. Our results support the World Bank's (World Bank, 2005) claim of "a growing appreciation among economists that education [of politicians] may be important because of its role in inculcating civic values."

What are the policy implications of these results? Do they imply that it might

actually be desirable that people would vote for experts only? Clearly, other characteristics of politicians also matter for successful policy, profession and education alone do not guarantee success. In addition, the focus of our analysis was restricted to economic policy reforms. Arguably, other policy dimensions are equally or even more important than market-oriented reforms. Whether and to what extent those types of education and profession identified here as being supportive for market-liberal reforms are also successful in other areas is hence an interesting question. Consequently, the effect of education and profession of heads of government on fiscal policy is discussed in the following chapter. The study of other policy fields remains for future research.

As an obvious extension, the focus of the analysis might be broadened to the entire cabinet instead of just looking at the heads of governments. This may be done in several ways. First, similar to the analysis presented above, it might be interesting to study whether the professional background of ministers matters for their own field of policy, and whether the impact of politicians differs between policy fields. Whether the type of field ministers or those of the head of government dominates policy outcomes is also a question we leave for future research. Furthermore, different types of head of governments might choose different types of ministers, giving rise to interesting interactions. Our analysis provides a starting point for many interesting questions on the impact of education and profession of politicians on policy outcomes.

3.6 Tables

Table 3.8: *Variable definitions and sources*

Variable	Description	Source
Economic Freedom	Composite index of economic freedom. Ranges from 0-10, with higher values reflecting greater freedom.	Gwartney and Lawson (2004)
Area 1	Size of Government Index. Ranges from 0-10, with higher values reflecting greater freedom.	Gwartney and Lawson (2004)
Area 2	Legal Structure and Security of Property Rights Index. Ranges from 0-10, with higher values reflecting greater freedom.	Gwartney and Lawson (2004)
Area 3	Access to Sound Money Index. Ranges from 0-10, with higher values reflecting greater freedom.	Gwartney and Lawson (2004)
Area 4	Exchange with Foreigners Index. Ranges from 0-10, with higher values reflecting greater freedom.	Gwartney and Lawson (2004)
Area 5	Regulation of Credit, Labour and Business Index. Ranges from 0-10, with higher values reflecting greater freedom.	Gwartney and Lawson (2004)
Growth per capita	GDP per capita growth (constant 2000 US$).	World Bank (2006)
Linguistic fractionalization	$Fractionalization_j = 1 - \sum_{i=1}^{n} s_{ij}^2$ with s_{ij} being the share of group i in country j.	Alesina et al. (2003)
Civil liberties	Index ranging from 1 to 7; rescaled so that higher values reflect more liberty.	Freedom House (2002)
Aid (percent of GDP)	Actual international transfer of financial resources or of goods or services valued at the cost to the donor, less any repayments of loan principal during the same period. Grants by official agencies of the members of the Development Assistance Committee.	World Bank (2006)
Time in office	Number of years the incumbent has been in office.	Various sources
Left wing governments	Dummy variable that is one for left-wing governments, and zero otherwise.	Beck et al. (2001)
Instability	First principal component of various instablity indicators (number of assassinations, strikes, guerilla warfare, major crises, riots, and revolutions in a particular country and year, and the number of successful coups d'etat).	Dreher (2006)
Currency Crises	A country is defined as experiencing a currency crisis when index covering the rate of change of the exchange rate and international currency reserves is one standard deviation greater than the index mean.	Dreher and Karb (2006)
Government fractionalization	Probability that two random draws will produce legislators from different parties.	Beck et al. (2001)
Coalition government, dummy	Dummy taking the value one if the current government is a coalition of at least two parties.	Beck et al. (2001)
Direct presidential, dummy	Dummy for systems with unelected executive presidents and presidents who are elected directly or by an electoral college.	Beck et al. (2001)
Veto players drop (percent)	Counts the percent of veto players who drop from the government in any given year. In presidential systems, the veto players are the president, the largest party in the legislature, and the largest party in the Senate; for parliamentary systems, veto players are defined as the PM and the three biggest coalition members.	Beck et al. (2001)
Control of all houses, dummy	Party of head of government controls all relevant houses.	Beck et al. (2001)

Table 3.9: *Descriptive statistics*

Variable	*Mean*	*Minimum*	*Maximum*	*Standard Deviation*
Economic Freedom, initial	5.61	3.65	7.90	1.04
Reform index (change in economic freedom)	0.20	-1.80	2.50	0.58
Area 1, initial	5.30	1.10	8.40	1.54
Area 1, change	0.13	-3.00	4.80	0.88
Area 2, initial	5.09	1.25	8.30	1.87
Area 2, change	0.16	-2.40	3.90	1.00
Area 3, initial	6.73	2.55	9.40	1.49
Area 3, change	0.36	-6.40	6.10	1.60
Area 4, initial	5.80	2.20	9.05	1.61
Area 4, change	0.27	-2.80	3.20	0.84
Area 5, initial	5.15	2.50	7.30	1.08
Area 5, change	0.13	-1.45	3.30	0.62
Growth per capita	1.99	-8.97	10.67	2.59
Linguistic fractionalization	0.30	0.01	0.90	0.27
Civil liberties, initial	-3.36	-7.00	-1.00	1.88
Civil liberties, change	0.12	-2.00	4.20	0.73
Aid (percent of GDP)	2.07	-0.03	38.84	4.38
Time in office	5.35	1.00	32.50	4.78
Left wing governments	0.37	0.00	1.00	0.44
Instability	-0.04	-0.43	2.49	0.48
Currency Crises	0.22	0.00	1.00	0.27
Government fractionalization	0.16	0.00	1.00	0.37
Coalition government, dummy	0.45	0.00	1.00	0.50
Direct presidential, dummy	0.41	0.00	1.00	0.49
Veto players drop (percent)	0.14	0.00	1.00	0.16
Control of all houses, dummy	0.48	0.00	1.00	0.49

Note: Based on estimation sample, Table 3.2, column 1

Table 3.10: *Areas and components of the Economic Freedom Index*

Area 1: Size of Government: Expenditures, Taxes and Enterprises
1A General gov't consumption as share of total consumption
1B Transfers and subsidies as a share of GDP
1C Gov't enterprises and investment as a share of gross investment
1D Top marginal tax rate
1Di Top Marginal Income Tax Rate
1Dii Top Marginal Income and Payroll Tax Rate
Area 2: Legal Structure and Security of Property Rights
2A Judiciary independence
2B Impartial courts
2C Protection of intellectual property
2D Military in Politics
2E Law and Order
Area 3: Access to Sound Money
3A Avg. growth of money (last 5 years) minus growth of real GDP (last 10 years)
3B Standard deviation of annual inflation (last 5 years)
3C Annual inflation (most recent year)
3D Freedom of citizens to own foreign currency bank accounts (domestically and abroad)
Area 4: Freedom to Trade Internationally
4A Tarrifs
4Ai International trade tax revenues (% of trade sector)
4Aii Mean tariff rate
4Aiii Standard deviation of tariff rates
4B Regulatory Trade Barriers
4Bi Hidden import barriers
4Bii Costs of importing
4C Actual vs. expected size of trade sector
4D Difference between official and black mkt exchange rates
4E International Capital Market Controls
4Ei Access of Citizens to foreign captial markets/foreign access to domestic capital markets (GCR)
4Eii Restrictions in Foreign Capital Market Exchange/Index of capital controls among 13 IMF categories
Area 5: Regulation of Credit, Labour, and Business
5A Credit Market Regulation
5Ai Ownership of banks
5Aii Competition in domestic banking
5Aiii Extension of credit
5Aiv Interest rate regulations (leading to neg. rates)
5Av Interest rate controls
5B Labor Market Regulations
5Bi Impact of minimum wage
5Bii Hiring and firing practices
5Biii Labor force share with wages set by centralized collective bargaining
5Biv Unemployment insurance
5Bv Use of conscripts
5C Business Regulations
5Ci Price controls
5Cii Administrative Conditions/Entry of New Business
5Ciii Time with government bureaucracy
5Civ Starting a new business
5Cv Irregular payments

Table 3.11: *Dreher and Lamla (2007), Crisis and the selection of leaders*

	Profession							*Education*				
	(1) entrepreneur	*(2) union executive*	*(3) science economics*	*(4) science other*	*(5) military*	*(6) politician*	*(7) other prof*	*(8) economics*	*(9) natural science*	*(10) other university*	*(11) unknown*	*(12) not university*
Growth p.c.	-23.760	-0.260	0.108	0.089	0.003	-0.043	-0.016	0.045	0.121	0.0887*	-0.103	-0.074
		(-0.61)	(1.30)	(1.57)	(0.04)	(-0.84)	(-0.31)	(0.61)	(0.76)	(1.76)	(-1.21)	(-1.09)
Inflation	-1265.100	-9.296	2.104	1.271	0.060	0.248	-0.149	1.269	-0.323	0.877	-2.272	-0.066
		(-0.73)	(1.02)	(1.38)	(0.05)	(0.17)	(-0.09)	(0.81)	(-0.15)	(0.84)	(-1.27)	(-0.05)
Civil liberties			0.405**	0.474**	-0.757***	-0.226	-0.058	0.686***	0.728**	0.099	-0.180	-0.531***
			(2.37)	(2.47)	(-3.96)	(-1.55)	(-0.34)	(3.77)	(2.23)	(0.79)	(-0.94)	(-2.83)
Left			0.133	-0.081	-1.319	0.460	0.285	0.293	-1.881	-0.033	0.003	0.075
			(0.18)	(-0.17)	(-1.53)	(1.14)	(0.51)	(0.51)	(-1.40)	(-0.08)	(0.00)	(0.11)
Instability		-0.523	0.184	0.027	0.350	-0.265	0.169	0.168	-1.227	0.237	0.088	-0.378
		(-0.27)	(0.53)	(0.10)	(0.93)	(-0.77)	(0.55)	(0.61)	(-1.14)	(1.06)	(0.21)	(-1.12)
Constant	49.610	-0.458	-2.475***	-0.155	-4.005***	-1.820***	-2.460***	-0.531	-1.127	0.020	-2.331***	-3.166***
		(-0.40)	(-3.21)	(-0.29)	(-5.28)	(-3.22)	(-2.96)	(-0.86)	(-1.34)	(-0.04)	(-3.78)	(-5.01)
Observations	15	23	126	126	126	126	126	126	126	126	126	126

Notes: Pooled Logit estimation with standard errors clustered at the country level. The dependent variable is a dummy indicating that a leader with certain profession/education is appointed. As countries with no time series variation for a particular profession or education have to be dropped, this leaves us with 41 countries and between 1–9 observations per country (average of 3.1). In column (1) the variables Civil Liberties, Left and Instability show no variation across the reduced samples and hence are omitted. This reduces the number of observations to 15, so the regression is meaningless and just reported for completeness. Analogously, in column (2) the variables Civil Liberties and Left are dropped.

*(Absolute) z-statistics in parentheses. * denotes significant at 10% level, ** significant at 5% level, *** significant at 1% level.*

Chapter 4

The Impact of Political Leaders' Profession and Education on Public Finance

The Impact of Political Leaders' Profession and Education on Public Finance[1]

4.1 Introduction

The political economy literature on public debt and deficits has so far concentrated on three main aspects: politicians, voters, and political institutions. Early contributions to the literature have mainly concentrated on opportunistic and partisan motives of policymakers that intend to maximize support from the electorate, or use fiscal policy to benefit their own constituencies, and on distributional conflicts, either caused by politicians with heterogeneous preferences or by social groups competing in the distribution of resources, while the more recent literature has shifted the focus towards the influence of political institutions on public finance.

The early literature on opportunistic motives concentrates on the strategic manipulation of public expenditures by policymakers trying to get re-elected. The key argument here is that politicians can gain support from the electorate by providing high levels of debt financed public expenditures, and hence increase the issuance of public debt beyond the optimal level, as voters are subject to fiscal illusion, i.e. they underestimate the future tax burden of today's public deficits. Studies on the partisan influence on fiscal policy argue that fiscal policy is determined by political ideology, i.e. that left-wing governments tend to overspend on social issues and to boost the economy, while the right runs a more prudent fiscal policy.

The literature on the effect of distributional conflicts on fiscal policy can be grouped into three main branches. The first claims that policymakers are tempted to tie the hands of successors with different preferences through the strategic use of deficits, while the second branch of this literature argues that necessary fiscal adjustments are postponed, and hence the fiscal stance is worsened, due to conflicts about the distributional consequences of the fiscal adjustment. The third branch argues that overspending is a result of a common pool

[1]This chapter is based on Mikosch and Somogyi (2009).

problem, i.e. of the conflict of different groups over the distribution of public funds.

This literature already links fiscal outcomes to characteristics of the political system, to government fragmentation, polarization, and ideology. An in depth analysis of political and fiscal institutions is given in the literature focusing on the effects of rules, procedures and practices in the budgetary process. Here, the focus lies on differences in the aggregation process of the conflicting interests mentioned above, and on the implementation of fiscal policy.

However, the political economy literature can only claim partial success in explaining public deficits and public debt, as all politico-economic approaches taken together can only explain about fifty percent of international differences in government debt (Franzese, 2001). This leaves a lot of room for new explanations, and finding a new explanation for variations in fiscal policy is the task of this study.

Therefore, we take a step further by going back to start, that is, we focus on policymakers. Differences in preferences and strategic interaction between politicians play a major role in the current literature explaining the emergence and persistence of public deficits. Differing preferences were, however, not explained, but merely assumed. In this chapter, we argue that one source of different preferences lies in the different socialization of policymakers, which is reflected by their education and profession.

This view is supported by the recent, and growing, literature connecting policy outcomes and personal traits of politicians. This strand of the literature argues that it matters who the actual leader is, that the peer group of the political leader makes a difference, and that the education and profession of a policymaker contributes to the shaping of his personal values, resulting in different outcomes both at the macro level (GDP, Inflation) and also at the micro level, especially in differences in the opportunistic behavior of policymakers.

We consequently argue that the socialization, the character and preferences – short: the personality – of policymakers, shaped by their education and profession, is a key determinant of fiscal performance. Employing panel data over the period 1970–2004, we present empirical evidence based on our data set covering profession and education of political leaders prior to entering office from

22 OECD countries. In a nutshell, our results show that education and profession indeed matter for fiscal policymaking, that former civil servants and military officers generate higher deficits than the other groups of politicians, that the policies of professional politicians differs depending on their education, that partisanship depends on the former profession and peer group of the politician, and that institutional sclerosis reduces the positive influence of economists on the budget surplus.

We test our hypothesis that the education and profession of policymakers matters for fiscal policy using pooled time-series cross-section (panel) data for 22 OECD countries for the period of 1970–2004. The chapter proceeds as follows: The next section gives an overview of the literature on the political economy of fiscal policy and on personal characteristics of policymakers and policy outcomes. The data and method of our empirical study are presented in Section 4.3. Section 4.4 presents our results, Section 4.5 concludes.

4.2 Literature Review

In this chapter, we argue that differences in the personality of policymakers, as proxied by their education and profession, are an additional explanation for international differences in public finance.

In most early contributions to the literature on public deficits and debt, preferences of and strategic interaction between political actors, i.e. between politicians, voters or social groups, play a major role, while the more recent literature has shifted its focus towards the institutions of the budgetary process.

In their seminal contributions on opportunistic behavior of policymakers, Wagner (1976) and Buchanan and Wagner (1977) argue that voters overestimate the value of (current) government expenditure and underestimate the resulting future tax burden. To win the favor of voters, opportunistic incumbents will hence run deficits to finance current overspending. A related inter-temporal approach is taken by Browning (1975), Tabellini (1991, 2000) and Cukierman and Meltzer (1989), who argue that current generations vote in favor of issuing government debt, which has to be repaid by generations that do not yet take part

in the voting process. Nordhaus (1975) links this to the occurrence of election years, resulting in the now vast literature on political business cycles. Following Nordhaus (1975) and the subsequent literature, policymakers run deficits before elections to stimulate the economy or to benefit specific groups that are decisive for the election outcome. Elections are then followed by expenditure cuts, leading to a politically induced business cycle. However, these expenditure cuts will not be sufficient to offset the past excessive spending, leading to a cyclical ratcheting effect in public debt.[2] These early models however imply that voters are subject to fiscal illusion, i.e. that they make consistent mistakes and are repeatedly fooled by politicians. However, Rogoff and Sibert (1988) and Rogoff (1990) show that opportunistic spending can lead even rational voters to vote for the incumbent, under the assumption that there is imperfect information about the policymaker's competence, and if the size of government spending is a signal of competence. The empirical findings on political business cycles are however mixed. Using samples including developed and developing countries, Persson and Tabellini (2003) and Brender and Drazen (2005, 2008) find neither a significant change in public expenditure or public deficits prior to elections, nor an effect of expansionary fiscal policy on re-election prospects. For samples covering only developing countries, however, Schuknecht (1996) and Shi and Svensson (2006) find evidence on the existence of political budget cycles. These results are however due to the effect of transition countries, i.e. new democracies, and vanish after the transition to democracy (Brender and Drazen, 2005). Recently, Aidt et al. (2009) find evidence for the strategic manipulation of fiscal policy before an election using a sample of 578 Portuguese municipalities. Furthermore, they find opportunistic behavior to be more pronounced the smaller the winning margin in the election is.

The conventional wisdom on the partisan effect (Hibbs, 1977; Alesina, 1987) on fiscal policy has it that the left tends to use fiscal policy as a counter-cyclical tool, resulting in larger spending, and is more prone to use redistributive measures, resulting in higher tax rates, while the right is less inclined to engage in such activism. While the empirical evidence on the partisan effect on tax rates and the size of government is rather clear (Allers et al., 2001; Bjørnskov, 2005),

[2]See e.g. Hercowitz and Strawczynski (2004) and Balassone et al. (2008).

the literature studying the effect of political ideology on public deficits finds either a deficit increasing effect of left-wing governments (Alesina et al., 1993), no effect (de Haan and Sturm, 1994, 1997) or even a deficit-lowering effect of left-wing governments (Garrett and Lange, 1991).

Distributional conflicts between policymakers, or between social groups, are at the core of another strand of the literature. A strategic interaction approach is taken by Persson and Svensson (1989), Alesina and Tabellini (1990), and Tabellini and Alesina (1990), who look at differences in preferences concerning the composition of public spending and the total size of the government budget. They argue that policymakers strategically issue debt in order to tie the hands of a possible successor from another party, i.e. to limit the successor's leeway in policymaking once he is in power, leading to an overissuance of debt compared to what would be optimal. In a similar approach, Aghion and Bolton (1990) argue that policymakers make strategic use of debt policy to endogenously affect election outcomes. The idea is that by influencing the economic environment that an opponent will inherit after an election, the incumbent can affect the electorate's expectation of macroeconomic performance under that opponent, which in turn influences the election probability of the opponent. The empirical evidence on this channel is however rather mixed. For example, Lambertini (2003) finds no evidence for strategic manipulation in US states and OECD countries. Pettersson-Lidbom (2001) however find empirical support using a sample of Swedish municipalities.

Alesina and Drazen (1991) argue that disagreement between groups about the burden of taxation leads to delay in fiscal adjustments, and hence to persistent and probably worsening deficits. The model was extended by Spolaore (1993), who shows that coalition governments would delay fiscal adjustment relative to single party governments. In addition, he finds that this inefficiency is increasing in the number of parties in the government. However, Drazen (2000, p. 693) argues that the effect could go either way, as a larger number of parties in the government gives way to the formation of sub-coalitions. Roubini and Sachs (1989) argue that coalition members have different constituencies with possibly divergent interests. They face a prisoner's dilemma with respect to budget cuts, as all the partners prefer comprehensive budget cuts with re-

spect to the continuing large deficits. However, each of them has an incentive to protect a particular part of the budget from cuts. The non-cooperative solution prevails over the cooperative one and therefore the budget does not get adjusted. Similar results on the sources of government deficits and persistent growth of public debt are found in common property (pork barrel) models[3], where interest groups try to expend resources to try to get a larger share of some common property.

This literature already links fiscal outcomes to characteristics of the political system, to government fragmentation, polarization, and ideology. A detailed analysis of political and fiscal institutions is given in the literature focusing on the effects of rules, procedures and practices in the budgetary process. Here, the focus lies on differences in the aggregation process of the conflicting interests mentioned above, and on the implementation of fiscal policy. Specifically, the literature looks at the effectiveness of explicit fiscal rules, such as numerical targets or balanced budget rules, and at rules determining the design of, voting on and implementation of the budget. Von Hagen (1992) studies the effect of procedural rules on fiscal outcomes for a sample of European countries, finding that greater hierarchy and larger transparency in the budgetary process increase fiscal discipline. Similar conclusions are drawn by Alesina et al. (1999), studying a sample of Latin American countries. Empirical evidence on other institutional variables, such as the number of government lawyers, differences between presidential and parliamentary systems or federal vs. centralistic states, is however rather weak and mixed.[4]

Recently, there is a growing literature connecting personal traits of politicians with actual policy outcomes. Jones and Olken (2005) show that who is the head of government matters for economic growth, as they find that unpredictable changes in a country's leadership due to the incumbent's death can trigger changes in the GDP growth rate. The consequences of unexpected changes in leadership are found to be substantial: Following a leader's death, the variability of GDP growth increases by 31 percent.

The relationship between the peer groups of politicians and policies that

[3]See e.g. Velasco (1998).

[4]See e.g. Roubini and Sachs (1989), Grilli et al. (1991).

benefit the respective group, or are in line with the peer groups' views, are studied by Pande (2003), Chattopadhyay and Duflo (2004), and Washington (2006). Pande (2003) looks at the effect of reservation of political mandates for members of disadvantaged castes and tribes in India and finds that this has resulted in an increase in targeted transfers to these groups. A similar regulation for Indian women has led to policies benefiting especially women (Chattopadhyay and Duflo, 2004). Finally, Washington (2006) finds that US congressmen with daughters are substantially more likely to vote in-line with feminist views.

The relationship between a person's education and his or her behavior in economic decision making has been studied by Frank et al. (1993, 1996), Frey et al. (1993), Frey and Meier (2003) and Rubinstein (2006). Frank et al. (1993) report evidence that students of economics tend to be more selfish and less cooperative than students of other faculties. In a natural experiment, Frey and Meier (2003) find substantial differences in donation behavior between students of various faculties. However, they find that it is not economists, but business students that are more selfish. In addition, they find that these differences are not due to a brainwash during the studies, but due to a self-selection of selfish people into the respective fields of study. Rubinstein (2006) conducts a survey among students of four different faculties at Tel Aviv University, among readers of an Israeli business newspaper and among Harvard PhD students, finding strong differences in attitudes towards profit maximization and firing workers between students and former students of different faculties. Such differences in behavior might of course not only be limited to current or recent students, but are likely to remain during the lifetime of a person. In addition to the education, other influences might shape a person's preferences and attitudes, a clear candidate being the profession the person exerts after receiving his education.

Consequently, the impact of education and profession on policymaking has also been in the focus of previous literature. Recent empirical evidence is provided by Göhlmann and Vaubel (2007), who show that the effectiveness in controlling inflation is directly linked to the education and profession of the central bank's governing council members. Personal career ambitions are found to affect the performance of central bankers by Adolph (2004). Concerning the education of politicians, Duflo (2005) shows that the reservation of political power

for historically disadvantaged groups and women in India did not influence the quality of decision making, even though this brought relatively inexperienced and uneducated politicians to power. Evidence leading in the opposite direction is presented by Besley et al. (2005), who show that differences in the performance of Indian village politicians are linked to politicians' education. In particular, education significantly reduces the probability that a politician uses his power in an opportunistic way.

Opportunistic behavior, as discussed above, is one main reason for excessive public deficits. In addition, distributional conflicts leading to overspending can be assumed to result in different policy outcomes if policymakers are influenced by their peer group. In this study, we hence concentrate on the effect of the personal characteristic traits of policymakers as determinants of public deficits.

4.3 Data and Methodology

As outlined above, we investigate the influence of political leader's education and profession on the government surplus.

We use pooled cross-section time-series (panel) data for 22 OECD countries covering the period from 1970–2004. Our main dependent variable is the primary public surplus in percent of GDP as provided by the OECD (2009) Economic Outlook database. As main explanatory variables, we use the education and profession data that has been described in detail in Section 3.2 of the previous chapter. The full data set contains data on the education and former profession of more than 500 heads of states from 73 countries for the period of 1970 to 2005. Profession is split into ten subcategories in the original dataset, we regroup them into eight categories: politicians, economic scientists, entrepreneurs, union executive and workers ('blue collars'), managers ('white collars'), lawyers, other scientists and heads of government with other professions, the difference to the original data set being the merge of the groups union executive and workers into one single group and other profession and military professionals into another single group. Education is measured with the help of seven sub-categories, with a separate group for political leaders with univer-

sity education in political sciences, economics, law, natural sciences and other university education, as well as two groups for leaders with non-university education and unknown education, respectively. This classification is more fine grained as in the previous Chapter 3 due to a larger number of available observations, except for military professionals, which are now grouped into the 'other' professions category. [5]

Furthermore, we employ various political economy variables taken from the Beck et al. (2001) database of political institutions in order to test for the theories presented in the literature overview. Specifically, we use a dummy variable indicating whether the head of government is from a left wing party (leftchiefparty),[6] and a variable indicating the time the party of the chief executive has been in office so far (prtyin).[7] In order to check for fractionalization (Roubini and Sachs, 1989) and war-of attrition effects as postulated by Alesina and Drazen (1991) and Spolaore (1993), we employ a variable measuring the fragmentation within the government (govfrac).[8] The strength of the government is measured by a variable indicating the majority degree the government has in the legislature (maj). In order to control for the effects of different political systems, we use a dummy variable (system) taking the value 1 if the country has parliamentary system, and zero otherwise.[9] Political business cycle theories are implemented into our empirical model with a dummy variable indicating whether there is a legislative election in a specific year (legelec). Whether the leeway of a national government concerning fiscal policy is restricted by the regulations of the Economic and Monetary Union of the European Union (convergence criteria before the introduction of the Euro, Stability and Growth Pact thereafter) is controlled for by a dummy variable.

In addition to these political economy variables, we include some variables

[5] In Chapter 3, the number of countries in the sample is larger, but the number of observations is lower, as the dependent variable is available only on a five-yearly basis.

[6] Names in parentheses are the names of the series in the original data set of Beck et al. (2001).

[7] See Section 3.4 of the previous chapter on the interplay between profession, education, time in office and economic reforms.

[8] See also Ricciuti (2004).

[9] In the original source, political systems are categorized into three types: Direct presidential, strong president elected by assembly and parliamentary. In line with the literature (see e.g. Campos and Giovannoni, 2007), we regroup them into the two categories described above.

reflecting the countries' current economic condition. These are the growth in GDP,[10] which is taken from World Bank (2009), and the change in the unemployment rate, which was collected from various sources.

Finally, in line with Volkerink and de Haan (2001), we control for a budgetary item that is not in the hand of the current government, but a result of past fiscal policy: Gross government interest payments. Data for this variable was also taken from OECD (2009). Exact definitions and descriptive statistics for all variables are provided in Tables 4.5 and 4.6 in Section 4.6 at the end of this chapter.

In our model we view the government budget surplus in country i at time t as a function of the education and/or profession of the head of government and a set of country-specific controlling factors. Hence, the equations estimated take the following form:

$$surplus_{it} = \alpha + \beta_1 prof_{it} + \beta_2 educ_{it} + \gamma X_{it} + \eta_t + \epsilon_{it}, \tag{4.1}$$

where $surplus_{it}$ represents the primary government surplus as a percentage of GDP, $prof_{it}$ is the vector of professions of the head of government in country i at time t, and $educ_{it}$ represents education. X is the vector of control variables, η_t are fixed country effects, while ϵ_{it} is the disturbance.

The regressions are estimated using feasible generalized least squares (FGLS). This allows estimation in the presence of AR(1) autocorrelation within panels and cross-sectional heteroskedasticity across panels.[11]

We also report results using two alternative estimators in order to test for the robustness of our results, the first being pooled OLS with a lagged dependent variable and robust standard errors clustered at the country level (which is identical to the within-groups (fixed effects) estimator). The inclusion of a lagged

[10] The correlation coefficient between GDP growth and inflation is 0.81. We consequently drop inflation from our sample.

[11] The FGLS estimator has been shown to perform efficiently under heteroskedasticity and autocorrelation as compared to standard panel estimators. Note that the FGLS correction for a single AR(1) term is unlikely to cause the standard errors to be flawed as would be the case employing the Parks correction with individual AR(1) terms for each country (Beck and Katz, 1995, p. 637). The procedure of estimation employed here is standard in the recent literature. See e.g. Kilby (2006).

dependent variable potentially leads to inconsistent coefficient estimates. The inconsistency arises because the fixed effects transformation induces a negative correlation between the transformed lagged dependent variable and the transformed error term. This is often referred to as the Nickell bias (Nickell, 1981). However, this correlation vanishes with large T, in which case the fixed effect estimator is consistent (Arellano, 2003). Judson and Owen (1999) show that for $T > 30$, Nickell bias in fixed effects models with a lagged dependent is of minor concern. They furthermore show that for $T > 30$, this estimation procedure performs better than the one-step and two-step GMM estimators proposed in Arellano and Bond (1991). Hence, in our panel with 34 years, T is large enough for inconsistency not to be a serious concern. Finally, we employ the panel corrected standard errors estimator as suggested by Beck and Katz (1995), correcting for first-order autocorrelation. As a further robustness check, we estimate three separate equations for each model, the first including both education and profession variables, the other two excluding one of the categories. This is done to deal with possible collinearity between some of the profession and education categories.

One might argue that voters vote for certain types of politicians in certain (adverse) economic situations, which would cause endogeneity problems in our analysis. However, we have not found a single occasion where a politician has used his education or profession as an argument in an electoral campaign. Hence, we believe that endogeneity is not an issue here. Furthermore, Dreher and Lamla (2007)[12] show that selection of politicians with various backgrounds is almost idiosyncratic. They establish that profession and education of politicians is clearly not related to fundamental political and economic variables. The next section presents the results.

4.4 Results

Table 4.1 presents results of the regressions including the dummies for profession and education of the chief government politician both simultaneously and

[12]See the discussion of their results in Section 3.2 and the respective Table 3.11 in Section 3.6 of the previous chapter.

separately in addition to the covariates discussed in the previous section. We omit the categories 'whole work life politician' and 'politics education'. Hence, the interpretation of all results regarding the impact of a politician's profession or education is relative to these baseline groups. In columns 1-3 we report the results of the FGLS estimations, columns 4-6 show the estimations using pooled OLS and columns 7-9 present the results from the estimations with panel corrected standard errors.

As can be seen, all economic control variables are significant and of the expected sign across all regressions. The GDP growth rate is found to be positively related to the budget surplus. An increase in the unemployment rate leads to a significant decrease in the budget surplus. The same result is found for the growth rate of government interest payments.

Turning to the political control variables, we find very interesting results. First, we find strong evidence for the effectiveness of fiscal rules. The coefficient of the dummy variable for countries subject to the regulations of the Maastricht treaty is significant and positive across all regressions.

Furthermore, and in line with the preceding literature (de Haan and Sturm, 1994, 1997), we find no significant effect of political ideology, as measured by the dummy for left wing parties.

A remarkable result is found for the dummy variable indicating the occurrence of election years. So far, the empirical literature has found evidence for the existence of political budget cycles only using local-level data or data from developing or transition countries, or in studies looking at revenues or single budgetary items, while there was no measurable effect on the budget balance in studies using data only from developed countries and established democracies. We however are the first to find strong evidence for such politically induced cycles in the budget balance also for OECD countries, as the coefficient of the dummy variable for election years is negative and significant throughout all regressions.[13] This difference to the previous literature is possibly due to our inclusion of profession and education variables in the regression, which might have removed an omitted variables bias. This lends further support to the con-

[13]This finding is robust to the exclusion of countries defined as new democracies in Brender and Drazen (2005) from our sample (Greece, Korea, Portugal, Spain).

Table 4.1: *Profession, Education, and Budget Surplus, 1970–2004.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lagged dependent				0.690***	0.705***	0.707***			
				[14.65]	[16.18]	[16.73]			
GDP growth	3.976	4.731*	5.034**	8.734**	9.182*	9.273**	5.219***	5.948***	6.980***
	[1.57]	[1.84]	[2.00]	[2.12]	[2.01]	[2.13]	[3.02]	[3.18]	[4.02]
Change in unemployment rate	-0.640***	-0.601***	-0.569***	-0.656***	-0.635***	-0.635***	-0.670***	-0.616***	-0.604***
	[8.51]	[7.83]	[7.78]	[7.92]	[7.70]	[7.77]	[12.72]	[10.57]	[11.57]
Growth in government interest payments	-2.326***	-2.171***	-2.171***	-2.002**	-1.861**	-1.839**	-2.913***	-2.665***	-2.782***
	[4.19]	[3.93]	[4.02]	[2.45]	[2.45]	[2.25]	[7.49]	[7.17]	[7.31]
Maastricht treaty	1.002***	1.106***	1.117***	0.571*	0.613*	0.582*	1.307***	1.380***	1.352***
	[3.34]	[3.57]	[3.64]	[1.73]	[1.75]	[1.91]	[7.72]	[8.26]	[7.40]
Left wing chief executive party	-0.219	-0.286	-0.102	-0.171	-0.219	-0.080	-0.131	-0.203	-0.028
	[1.03]	[1.35]	[0.50]	[0.85]	[1.20]	[0.39]	[0.69]	[1.01]	[0.17]
Chief executive party's years in office	0.038**	0.027	0.029*	0.012	0.012	0.008	0.042***	0.042***	0.037***
	[2.18]	[1.57]	[1.69]	[0.44]	[0.49]	[0.32]	[5.72]	[5.24]	[5.17]
Government fractionalization	1.336**	0.959	1.048*	-0.042	-0.040	-0.038	0.769*	0.545	0.586
	[2.11]	[1.54]	[1.69]	[0.06]	[0.05]	[0.05]	[1.91]	[1.36]	[1.53]
Majority degree of government in legislature	0.211	0.281	0.072	1.055	1.157	0.934	0.720	1.062	0.636
	[0.21]	[0.28]	[0.07]	[1.07]	[1.18]	[0.98]	[1.02]	[1.44]	[1.07]
Legislative election	-0.237**	-0.244**	-0.223**	-0.370**	-0.355**	-0.377**	-0.227***	-0.228***	-0.233***
	[2.26]	[2.33]	[2.17]	[2.38]	[2.19]	[2.46]	[2.79]	[2.73]	[3.19]
Profession									
science economics	0.100	-0.518		-0.575	-0.468		-0.177	-0.658	
	[0.13]	[0.75]		[0.78]	[0.57]		[0.43]	[1.64]	
entrepreneur	0.348	0.355		0.004	0.026		0.188	0.222	
	[0.44]	[0.50]		[0.02]	[0.12]		[0.54]	[0.61]	
manager/white collar	-0.659*	-0.895**		-0.877**	-0.948**		-0.919***	-1.166***	
	[1.68]	[2.46]		[2.58]	[2.13]		[2.69]	[3.34]	
union executive or worker/blue collar	0.881*	0.364		-0.173	-0.361		0.311	-0.263	
	[1.82]	[0.80]		[0.44]	[0.61]		[1.01]	[0.97]	
lawyer	0.032	0.463		-0.006	0.018		0.021	0.282	
	[0.08]	[1.34]		[0.02]	[0.06]		[0.07]	[0.90]	
profession: other science	1.453**	0.563		0.677	0.112		1.273**	0.393	
	[2.29]	[1.02]		[1.01]	[0.24]		[2.53]	[0.83]	
profession: other	-0.954*	-1.091**		-0.946***	-0.993***		-1.352***	-1.515***	
	[1.78]	[2.10]		[3.35]	[2.90]		[3.73]	[3.96]	
Education									
unknown	-1.104*		-1.007	-0.462		-0.648	-1.059***		-0.984***
	[1.76]		[1.61]	[0.52]		[0.68]	[3.03]		[3.05]
not university	-0.029		-0.335	0.037		-0.533	-0.129		-0.647*
	[0.05]		[0.62]	[0.11]		[1.16]	[0.33]		[1.90]
economics	-0.745		-0.739	0.117		-0.267	-0.596		-0.746**
	[1.32]		[1.49]	[0.31]		[0.59]	[1.52]		[2.47]
law	0.252		0.309	0.105		0.054	0.083		0.111
	[0.50]		[0.71]	[0.26]		[0.14]	[0.26]		[0.47]
natural science	-1.684**		-0.845	-0.906		-0.759	-1.630***		-1.080***
	[2.27]		[1.25]	[1.67]		[1.06]	[3.32]		[2.84]
other university	-1.270**		-1.270**	-0.434		-0.721	-1.396***		-1.650***
	[2.16]		[2.30]	[1.00]		[1.43]	[3.97]		[4.68]
Method		FGLS			pooled OLS			PCSE	
Observations	527	527	527	526	526	526	528	528	528
R-squared				0.79	0.79	0.79	0.31	0.27	0.27
Joint signif. (Prob>chi2)	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
	Absolute value of z statistics in brackets			*Robust t statistics in brackets*			*z statistics in brackets*		

Notes: The dependent variable is the primary government surplus as a percentage of GDP. All regressions contain fixed effects at the country level or country dummies (not reported). In columns 4-6, standard errors are clustered at the country level. Base categories: education: political science / profession: whole work life politician. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

sideration of personal characteristics of policymakers in the analysis of fiscal policy.

The evidence for the effect of the other political control variables is rather weak. We find some evidence for an increase in the surplus, the longer the chief executive's party has been in office. This might reflect the effect of experience in implementing policies and in organizing majorities in the parliament that younger governments lack to some extent. Government fractionalization is also found to increase the surplus. This seems counterintuitive at first sight, but is in line with an argument brought forth in Drazen (2000, p. 693), who argues that the negative effect of the distributional conflict between several government parties might be offset by the possibility to form sub-coalitions. Finally, we find some evidence for a deficit increasing effect of parliamentary systems, as compared to presidential systems, and no significant effect of the majority degree of the government party in parliament.

Concerning our specific research question our results reveal that profession and education of politicians indeed matter. The dummies are jointly significant at the one percent level, with one exception in column 6 (pooled OLS with standard errors clustered at the country level and separate inclusion of the education variables), where the covariates are only jointly significant at the ten percent level.

Turning to the individual impact of the different profession and education categories,[14] we find a robust negative influence of former managers or white collar workers on the public surplus. This can be explained by the fact that a large part of this group of white collar workers is made up by former civil servants and former employees of public authorities and publicly owned companies. These findings hence support the results of the literature linking policy outcomes to the effect of demands from or views of the peer group of a policymaker,[15] and might also be evidence for a partisan effect, where ideology is not measured by party affiliation, but by the values of the politician's peer group. Furthermore, we find a significantly negative effect on the budget surplus of

[14]Note again that all results are relative to the base categories, 'whole work life politician' and 'education in political science'.

[15]See e.g. Washington (2006).

politicians in the 'other' professions group. This group comprises politicians with professions in fields that are possibly less relevant for policymaking than having experience in law, as a union executive or as an economic researcher. However, and most importantly, also former military officials are part of this group. Military officials can be reasonably assumed to have a strong preference for spending on military goods. This again lends support to the hypothesis that politicians are influenced by the views and values of their peer group. These findings are not only robust to the variations in the estimation method, but also to the exclusion of the education categories from the list of variables (Columns 2, 5 and 8).

The evidence on the individual impact of the education categories is rather weak. This is however in line with our findings in Chapter 3. We find some evidence for a negative effect on the budget surplus for three groups: politicians with 'other university' education, politicians with a degree in natural sciences, and politicians with unknown (or no) education. The results for the 'other university' group supports our reasoning on the peer group effect above, as this group again comprises also high-ranked military officials with education from universities or military academies, while the negative coefficient of the group of politicians with unknown or no tertiary education shows that being educated at all matters for policymaking.

So far, we found that the impact of education is rather vague. However, going more into detail, we can show that education indeed matters. More specifically, we test whether politicians that have been politicians for all or most of their work life ('whole work life politicians') differ in their fiscal policies, depending on their education. This question is important as a relatively large share of the head of governments are 'whole work life politicians' (the 'whole work life politicians' category comprises about 40 percent of all the profession observations). Therefore, we interact the 'whole work life politicians' category with the education categories 'economics', 'law' and 'political science'.[16]

The results of this exercise is shown in Table 4.2. Again, we use three different estimators to check the robustness of our results. As can be seen, our results

[16]The choice of these three education categories is driven by the amount of available observations.

for the economic and political control variables are robust to the inclusion of the interaction terms. The same holds for the results concerning the profession categories, while some of the education categories turn insignificant. However, the education category 'law' is now significantly positive. This is extremely interesting when seen in combination with the result of the interaction term between law education and 'whole work life politician'. The coefficient of this interaction term is negative and significant across all regressions. This means that while professional lawyers run lower deficits than the average whole work life politician, those whole work life politicians with law education run significantly larger deficits than the average. The flip side of this effect is the positive coefficient of the interaction term between whole work life politicians and political science education. As former law students (and to some extent also former economics students, as indicated by one negative and significant coefficient) run surpluses below average, the sign of those politicians with political science education is positive.

In the regressions shown in Tables 4.1 and 4.2, we did not find evidence for partisan behavior in fiscal policy making, as the coefficient of the dummy variable for left-wing governments has been insignificant throughout all regressions. Now, we test whether such partisan behavior, as measured by political ideology, is only insignificant on average, but present for different subcategories of politicians. Therefore, we interact the dummy variables for the profession categories 'professional economist', 'lawyer', 'union executive', and 'whole work life politician' with the dummy variable for left-wing governments.

Table 4.3 presents the results for the interactions of political leaning and the profession of a head of government, again using three different estimation techniques. The odd numbered columns present the results including both the profession and education variables, while the even numbered columns show the regressions excluding the education variables.

Our previous results for the economic and political control variables remain robust across all specifications. The same is the case for the linear terms of the profession and education variables. Concerning the effect of political ideology on the fiscal policymaking of the different categories of politicians, we find a

strongly negative effect of left-wing economists on the public budget surplus. This effect is robust to all variations in the estimation procedure. Hence, we find robust evidence for the existence of partisan behavior for the group that is most likely to be influenced by ideology – or schools of thought – in economic policy making: Economists. Our results imply that left-wing economist, influenced by Keynesian economics, run significantly larger public deficits than the average former economic researcher in the position of a head of government. The coefficient of the interaction terms for the other profession groups is insignificant across all regressions, suggesting that ideology does not make a difference for these groups. For the group of former union executives and blue collar workers this finding comes as no surprise, as almost all politicians in this category are left-wing anyways.

Previous research suggests that policy outcomes also depend on experience. For example, Roubini and Sachs (1989) suggest that there is a tendency towards larger deficits in countries characterized by a short average tenure of government. They argue that budget reductions require political consensus which is harder to achieve by weaker governments, which can (inter alia) be proxied by expected tenure of office. So far, we have not found a significant effect of the time the governing party has spent being the ruling party prior to the entry of the current incumbent into office. However, we suspect that there are differential effects between the different types of politicians. We thus include an interaction term between profession/education, and the number of years that the chief executive's party has been in office before the chief executive was elected.[17]

[17] Using the time in office of the chief executive himself did not yield significant results.

Table 4.2: *Profession, Education, and Budget Surplus, 1970–2004, interactions of profession and education.*

	(1)	(2)	(3)
Lagged dependent		0.688***	
		[14.24]	
GDP growth	4.225*	9.231**	5.653***
	[1.67]	[2.12]	[3.65]
Change in unemp. rate	-0.629***	-0.643***	-0.661***
	[8.42]	[8.54]	[13.64]
Growth in govt. interest payments	-2.234***	-1.811**	-2.820***
	[4.03]	[2.19]	[7.54]
Maastricht treaty	1.008***	0.604*	1.311***
	[3.38]	[1.80]	[8.01]
Left wing chief executive party	-0.210	-0.118	-0.137
	[0.98]	[0.52]	[0.79]
Chief executive party's years in office	0.038**	0.016	0.046***
	[2.20]	[0.59]	[6.87]
Government fractionalization	1.324**	0.026	0.753**
	[2.10]	[0.04]	[1.96]
Majority degree of govt. in legislature	0.088	0.876	0.635
	[0.09]	[0.88]	[0.96]
Legislative election	-0.229**	-0.384**	-0.229***
	[2.18]	[2.40]	[3.05]
Profession			
science economics	-0.658	-1.017	-1.169**
	[0.69]	[1.19]	[2.48]
entrepreneur	-0.400	-0.442	-0.583
	[0.47]	[1.02]	[1.64]
manager/ white collar	-1.294**	-1.331***	-1.655***
	[2.49]	[2.96]	[4.14]
union executive/ blue collar	0.257	-0.513	-0.464
	[0.38]	[0.85]	[0.99]
lawyer	-1.080*	-0.798	-1.061**
	[1.85]	[1.61]	[2.18]
other science	0.559	0.130	0.356
	[0.76]	[0.18]	[0.67]
other	-1.398**	-1.207**	-1.799***
	[2.24]	[2.79]	[4.41]
Education			
unknown	0.228	0.704	0.318
	[0.26]	[1.02]	[0.40]
not university	1.539*	1.295***	1.425*
	[1.69]	[3.04]	[1.92]
economics	1.090	1.532**	1.508*
	[1.07]	[2.69]	[1.72]
law	2.702**	1.965***	2.517**
	[2.52]	[3.29]	[2.54]
natural science	0.219	0.570	0.245
	[0.20]	[0.77]	[0.24]
other university	0.293	0.798	0.151
	[0.33]	[1.70]	[0.20]
Interaction terms			
Whole work life politicians w/ econ. education	-0.731	-0.489	-1.196**
	[0.95]	[0.62]	[2.51]
Whole work life politicians w/ law education	-1.491***	-0.984***	-1.464***
	[2.59]	[2.87]	[3.34]
Whole work life politicians w/ pol. sci. education	1.186	1.326***	1.294*
	[1.35]	[3.02]	[1.69]
Method	FGLS	pooled OLS	PCSE
Observations	527	526	528
R-squared		0.80	0.32

Notes: The dependent variable is the primary government surplus as a percentage of GDP. All regressions contain fixed effects at the country level or country dummies (not reported). In column 2, standard errors are clustered at the country level. Base categories: education: political science / profession: whole work life politician. Note that the profession and education categories add up to 100 per cent and interactions with the base category can hence be included. Absolute value of z statistics (col.1), robust t statistics (col. 2), and z statistics (col. 3) in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 4.3: *Profession, Education, and Budget Surplus, 1970–2004, interactions of profession and political leaning.*

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged dependent			0.689***	0.704***		
			[15.22]	[16.90]		
GDP growth	5.051**	5.555**	9.537**	9.912*	6.056***	6.524***
	[1.99]	[2.17]	[2.19]	[2.05]	[3.40]	[3.39]
Change in unemp. rate	-0.630***	-0.590***	-0.643***	-0.626***	-0.667***	-0.613***
	[8.25]	[7.60]	[7.48]	[7.04]	[12.25]	[10.36]
Growth in govt. interest payments	-2.273***	-2.123***	-2.045**	-1.922**	-2.935***	-2.686***
	[4.12]	[3.87]	[2.58]	[2.61]	[7.54]	[7.25]
Maastricht treaty	1.021***	1.101***	0.592	0.625	1.323***	1.383***
	[3.39]	[3.55]	[1.66]	[1.67]	[8.31]	[8.31]
Left wing chief executive party	-0.154	-0.082	-0.059	-0.055	-0.070	0.009
	[0.49]	[0.27]	[0.26]	[0.26]	[0.24]	[0.03]
Chief executive party's years in office	0.038**	0.026	0.010	0.009	0.040***	0.040***
	[2.13]	[1.51]	[0.35]	[0.34]	[5.17]	[4.80]
Government fractionalization	1.531**	1.064	0.104	0.041	0.995**	0.682*
	[2.32]	[1.64]	[0.15]	[0.06]	[2.46]	[1.73]
Majority degree of govt. in legislature	0.346	0.338	0.999	1.049	0.827	1.113
	[0.35]	[0.34]	[0.97]	[1.01]	[1.15]	[1.47]
Legislative election	-0.221**	-0.227**	-0.365**	-0.348*	-0.216***	-0.216***
	[2.10]	[2.17]	[2.25]	[2.07]	[2.69]	[2.61]
Profession						
science economics	0.930	0.265	-0.121	-0.071	0.496	-0.051
	[1.14]	[0.36]	[0.15]	[0.08]	[1.40]	[0.15]
entrepreneur	0.415	0.336	0.105	0.100	0.260	0.212
	[0.53]	[0.47]	[0.37]	[0.45]	[0.76]	[0.59]
manager/ white collar	-0.702	-1.056***	-0.881**	-0.994**	-0.886**	-1.293***
	[1.63]	[2.68]	[2.43]	[2.26]	[2.46]	[3.52]
union executive/ blue collar	0.804	0.246	0.005	-0.180	0.610*	-0.079
	[1.32]	[0.42]	[0.01]	[0.28]	[1.89]	[0.31]
lawyer	0.043	0.424	-0.078	-0.073	0.063	0.290
	[0.08]	[1.02]	[0.16]	[0.21]	[0.18]	[0.92]
other science	1.381**	0.458	0.662	0.071	1.251**	0.261
	[2.15]	[0.83]	[0.86]	[0.15]	[2.44]	[0.57]
other	-0.930*	-1.198**	-0.917***	-1.019***	-1.218***	-1.583***
	[1.65]	[2.23]	[3.18]	[3.29]	[3.29]	[4.05]
Education						
unknown	-1.136*		-0.446		-1.111***	
	[1.68]		[0.47]		[3.10]	
not university	-0.114		0.018		-0.220	
	[0.18]		[0.04]		[0.52]	
economics	-0.756		0.106		-0.629	
	[1.31]		[0.25]		[1.53]	
law	0.241		0.149		0.067	
	[0.45]		[0.31]		[0.20]	
natural science	-1.550**		-0.877		-1.606***	
	[2.06]		[1.37]		[3.07]	
other university	-1.333**		-0.438		-1.540***	
	[2.10]		[0.78]		[4.01]	
Interaction terms						
Professional economist, left wing	-2.563**	-2.496***	-1.804**	-1.787**	-2.311***	-2.343***
	[2.55]	[2.59]	[2.81]	[2.48]	[2.88]	[2.63]
Lawyer, left wing	-0.049	-0.125	0.024	0.045	0.004	-0.151
	[0.11]	[0.29]	[0.07]	[0.14]	[0.01]	[0.34]
Union executive, left wing	0.074	-0.051	-0.363	-0.495	-0.470	-0.518
	[0.11]	[0.08]	[0.86]	[1.18]	[1.11]	[1.28]
Whole work life politician, left wing	0.029	-0.244	-0.047	-0.185	0.158	-0.184
	[0.07]	[0.64]	[0.12]	[0.64]	[0.52]	[0.59]

Notes: The dependent variable is the primary government surplus as a percentage of GDP. All regressions contain fixed effects at the country level or country dummies (not reported). In columns 3 and 4, standard errors are clustered at the country level. Base categories: education: political science / profession: whole work life politician. Note that the profession and education categories add up to 100 per cent and interactions with the base category can hence be included. Absolute value of z statistics (col.1+2), robust t statistics (col. 3+4), and z statistics (col. 5+6) in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

Table 4.4: *Profession, Education, and Budget Surplus, 1970–2004, interactions of profession and chief executive's party's time in office.*

	(1)		(2)		(3)		(4)		(5)		(6)	
	linear term	interaction w/ party's time in office	linear term	interaction w/ party's time in office	linear term	interaction w/ party's time in office	linear term	interaction w/ party's time in office	linear term	interaction w/ party's time in office	linear term	interaction w/ party's time in office
Lagged dependent					0.690***		0.706***					
					[14.40]		[16.24]					
Chief executive party's years in office	0.141		0.147		0.082		0.058		0.111		0.140	
	[0.89]		[0.99]		[0.71]		[0.62]		[1.02]		[1.44]	
Regressions include the same set of control variables as Tables 4.1 to 4.3. Results are robust and not reported here due to space restrictions.												
Profession												
science economics	1.750	-0.416*	1.007	-0.404*	0.681	-0.339	0.569	-0.318	1.676***	-0.438***	1.067*	-0.451***
	[1.55]	[1.82]	[0.95]	[1.86]	[0.80]	[1.51]	[0.56]	[1.54]	[2.82]	[3.30]	[1.72]	[3.50]
entrepreneur	0.000	-0.019	0.098	-0.050	-0.060	-0.067	0.001	-0.056	-0.046	-0.002	0.034	-0.041
	[0.00]	[0.07]	[0.08]	[0.19]	[0.13]	[0.52]	[0.00]	[0.45]	[0.11]	[0.01]	[0.10]	[0.31]
manager/white collar	-0.372	-0.119	-0.616	-0.135	-1.339**	-0.025	-1.550**	0.011	-0.583	-0.094	-1.031**	-0.104
	[0.61]	[0.71]	[1.06]	[0.87]	[2.48]	[0.20]	[2.44]	[0.10]	[1.30]	[0.79]	[2.30]	[0.98]
union executive or worker/blue collar	0.683	-0.069	0.141	-0.085	-0.406	-0.047	-0.733	-0.018	0.093	-0.036	-0.497	-0.068
	[1.14]	[0.43]	[0.24]	[0.56]	[0.72]	[0.38]	[1.04]	[0.17]	[0.24]	[0.36]	[1.45]	[0.78]
lawyer	0.200	-0.111	0.604	-0.127	0.301	-0.127	0.340	-0.107	0.437	-0.117	0.563*	-0.140
	[0.36]	[0.70]	[1.30]	[0.84]	[0.81]	[1.02]	[1.03]	[0.98]	[1.41]	[1.17]	[1.71]	[1.59]
other science	2.159**	-0.214	1.209	-0.225	0.623	-0.066	0.137	-0.062	1.922***	-0.163	0.972	-0.201
	[2.57]	[1.14]	[1.57]	[1.26]	[0.74]	[0.51]	[0.19]	[0.45]	[3.25]	[1.20]	[1.48]	[1.53]
other	-1.116	-0.054	-1.087	-0.105	-1.494***	0.033	-1.510***	0.042	-1.395***	-0.049	-1.398***	-0.120
	[1.40]	[0.27]	[1.38]	[0.55]	[3.20]	[0.27]	[3.11]	[0.37]	[2.68]	[0.40]	[2.62]	[1.15]
politician (base category)		-0.098		-0.117		-0.073		-0.052		-0.059		-0.090
		[0.63]		[0.81]		[0.63]		[0.58]		[0.52]		[0.90]
Education												
unknown	-1.010				-0.470				-1.055***			
	[1.53]				[0.52]				[3.14]			
not university	0.084				0.102				-0.095			
	[0.13]				[0.30]				[0.25]			
economics	-0.675				-0.044				-0.648			
	[1.12]				[0.11]				[1.57]			
law	0.301				0.120				0.003			
	[0.55]				[0.33]				[0.01]			
natural science	-1.735**				-0.790				-1.781***			
	[2.23]				[1.51]				[3.57]			
other university	-1.205*				-0.363				-1.440***			
	[1.92]				[0.80]				[3.92]			
Method	FGLS		FGLS		Pooled OLS		Pooled OLS		PCSE		PCSE	
Observations	527		527		526		526		528		528	
R-squared					0.80		0.80		0.32		0.28	

Notes: The dependent variable is the primary government surplus as a percentage of GDP. All regressions contain fixed effects at the country level or country dummies (not reported). In columns 3 and 4, standard errors are clustered at the country level. Base categories: education: political science / profession: whole work life politician. Note that the profession and education categories add up to 100 per cent and interactions with the base category can hence be included. Absolute value of z statistics (col.1+2), robust t statistics (col. 3+4), and z statistics (col. 5+6) in brackets. '', '**', '***' denote statistical significance at 10%, 5% and 1% levels respectively.*

The results of the respective estimations are shown in Table 4.4. We have again employed three different estimation techniques to check the robustness of our results. The odd numbered columns present the results of the estimations including education and profession variables simultaneously, while the even numbered columns show the results of the regressions excluding the education variables. As can be seen, the results concerning the economic and political control variables are fairly robust also to this variation in the estimation procedure. The same is the case for the linear terms of the education and profession variables, with one exception: We now find some evidence for a surplus-increasing effect of former economic researchers. However, looking at the interaction terms with the party's time in office, we find that this effect is the lower, the longer the party of the head of government has been the ruling party. Hence, it seems that if economists come into power directly after a regime change, they are able to get fiscal policy under their control and exert a positive effect on the surplus. However, if the economist is elected into an administrative environment that has long been in place, this positive effect is reduced, possibly due to the protection of vested rights of the past administration and growing inflexibility of the administrative body over time. This finding hence lends support to the theory of institutional sclerosis put forth by Olson (1982), which claims that the influence of vested interest groups increases over time, causing detrimental effects on economic performance.[18]

4.5 Conclusion

In this chapter, we have studied the effect of the education and former profession of political leaders on fiscal policy. We have argued that education and profession shape a person's values, his behavior and his attitudes towards economic and political decision making. Using panel data for 22 OECD countries covering the period of 1970–2004, we have found substantial evidence that profession and education do matter for fiscal policy making.

[18]See e.g. Heckelman (2000), Horgos and Zimmermann (2009) and Wilson et al. (2010) for empirical evidence of institutional sclerosis.

Specifically, we have found that education and profession per se matter, indicated by the joint significance of the respective variables. Concerning the specific fields, we have found strong negative effects of former white collar workers (including civil servants and public officials) and the group comprising former military officials on the government surplus. We have further found that education makes a difference even when we look at only one professional group. Here, we have found that heads of governments that have been politicians for their whole professional life cause higher deficits if they have a degree in law. Furthermore, we have found partisan behavior in fiscal policy making not only in the form of a peer group effect of former public servants and military officials, but we also find that strong evidence for partisan behavior when we interact profession and political leaning. This is especially interesting, as we, in line with the literature, find no effect of political ideology on fiscal policy outcomes per se. Finally, we find evidence for Olson (1982)'s theory of institutional sclerosis, as the positive effect of economists on fiscal policy is reduced, the longer the governing party has been in office. We furthermore are the first to have found strong evidence for the existence of politically induced budget cycles. Additionally, we have also shown that fiscal rules have a significantly disciplining effect on fiscal policy.

Extrapolating our results, we can formulate the following general hypothesis: In order to progress with political economy issues, researchers should not narrow their focus to differences in political institutions. Instead, they should pay more attention to differences between the political agents themselves, i.e. to the different personal characteristics – gender, age, experience, cultural, social, educational and professional background, political attitudes, personal values. This and the previous chapter, which discussed the influence of education and profession of heads of government on economic reforms, have added to the initial steps into this direction that have already been taken by Chattopadhyay and Duflo (2004) and Besley et al. (2005) who study the relation between politicians and quality of decision making in India, by Jones and Olken (2005), who investigate the effects of unexpected changes of heads of government on economic growth, by Adolph (2004) and Göhlmann and Vaubel (2007), who study the effects of central bankers' characteristics on inflation.

4.6 Tables

Table 4.5: *Variable definitions and sources*

Variable	*Definition*	*Source*
Primary govt. surplus, % of GDP	Primary central government surplus as a percentage of GDP	OECD (2009)
GDP growth	Percentage change of GDP compared to the previous year	World Bank (2009)
Change in unemployment rate	Difference between unemployment rate (in percent) in t and unemployment rate in t-1	various sources
Growth in government interest payments	Percentage change in government interest payments compared to the previous year	OECD (2009)
Maastricht treaty	Dummy for membership in EMU, =1 for members, 0 otherwise	Various sources
Left wing chief executive party	Dummy =1 if the party of the chief executive is left wing	Beck et al. (2001)
Chief executive party's years in office	Number of years that the chief executive's party has been in office before the chief executive was elected	Beck et al. (2001)
Government fractionalization	Government fractionalization. Probability that two random draws will produce legislators from different parties.	Beck et al. (2001)
Majority degree of government in legislature	Fraction of seats held by the government party	Beck et al. (2001)
Legislative election	=1 if there was a legislative election in this year	Beck et al. (2001)
Profession		
science economics	Dummy for former economic researcher	Dreher et al. (2009)
entrepreneur	Dummy for former entrepreneur	Dreher et al. (2009)
manager/white collar	Dummy for former office worker	Dreher et al. (2009)
union executive or worker/blue collar	Dummy for former union executives or blue collar worker	Dreher et al. (2009)
lawyer	Dummy for former lawyer	Dreher et al. (2009)
politician	Dummy for whole work life politician	Dreher et al. (2009)
other science	Dummy for former researcher in a field other than law, political science or economics	Dreher et al. (2009)
other	Dummy for all other former occupations	Dreher et al. (2009)
Education		
unknown	Dummy for unknown education	Dreher et al. (2009)
not university	Dummy for politician w/o university degree	Dreher et al. (2009)
economics	Dummy for degree in economics or business	Dreher et al. (2009)
law	Dummy for degree in law	Dreher et al. (2009)
politics	Dummy for degree in political science	Dreher et al. (2009)
natural science	Dummy for degree in natural science	Dreher et al. (2009)
other university	Dummy for a degree in a field other than the ones above	Dreher et al. (2009)

Table 4.6: *Descriptive statistics*

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Primary govt. surplus, % of GDP	528	0.02	3.20	-9.96	9.53
GDP growth	528	0.08	0.05	-0.05	0.27
Change in unemployment rate	528	0.09	1.03	-2.86	5.10
Growth in government interest payments	528	0.09	0.16	-0.24	0.78
Maastricht treaty	528	0.33	0.47	0	1
Left wing chief executive party	528	0.42	0.49	0	1
Chief executive party's years in office	528	7.52	7.72	1	40
Government fractionalization	528	0.27	0.27	0	0.83
Majority degree of government in legislature	528	0.54	0.10	0.11	0.93
Legislative election	528	0.28	0.45	0	1
Profession					
science economics	528	0.03	0.17	0	1
entrepreneur	528	0.02	0.16	0	1
manager/ white collar	528	0.12	0.32	0	1
union executive or worker/blue collar	528	0.10	0.31	0	1
lawyer	528	0.22	0.42	0	1
politician	528	0.38	0.48	0	1
other science	528	0.06	0.24	0	1
other	528	0.09	0.29	0	1
Education					
unknown	528	0.04	0.20	0	1
not university	528	0.12	0.33	0	1
economics	528	0.21	0.41	0	1
law	528	0.37	0.48	0	1
politics	528	0.14	0.34	0	1
natural science	528	0.07	0.25	0	1
other university	528	0.07	0.26	0	1

Notes: Based on regression sample of Table 4.1, Column 1.

Chapter 5

Tax Competition and Income Sorting: Evidence from the Zurich Metropolitan Area

Tax Competition and Income Sorting: Evidence from the Zurich Metropolitan Area[1]

5.1 Introduction

Since the seminal contribution of Tiebout (1956), a strong focus of the literature on fiscal federalism has been put on the analysis of market-like competition between jurisdictions. Tiebout showed that by voting with one's feet, there exists a mechanism that can reveal individual preferences for local public goods. Hence, fiscal decentralization appears to be efficiency enhancing, as it allows people with similar preferences concerning the provision of public goods to settle in communities that provide public goods at levels close to their preferences.[2]

Many of the results in this literature[3] rest on the assumption that households differ in their preference for public goods, but have equal incomes. The influence of income heterogeneity on households' locational decisions and the local provision of public goods were first studied by Ellickson (1971) and Westhoff (1977).[4] A core result of these models is the income segregation hypothesis. It postulates that if rich households esteem public goods less than poor households, fiscal federalism induces self sorting of the population by income. Following Schmidheiny (2006a), this clustering of rich and poor is even stronger in case of progressive tax schedules.

In this study, we use community-level data from the Swiss canton of Zurich to study the influence of income taxes on the distribution of households according to their taxable income. The situation in Swiss cantons is quite unique, as the progressiveness of the tax schedule is set at the cantonal level, while the communities within the canton can set the effective tax burden by applying a tax multiplier to the cantonal tax schedule. This enables us to study the effects

[1] This Chapter is based on Schaltegger et al. (2009).

[2] Similarly, Oates (1972) argues in his 'decentralization theorem' that there are no advantages associated with a centralized provision of public goods since differences in public good at the local level reflect differences in preferences across these jurisdictions.

[3] See Oates (1999), Wilson (1999) and Wilson and Wildasin (2004) for surveys.

[4] See also Ross and Yinger (1999) for a survey.

of tax differentials on the choice of residence within an economically and culturally homogeneous region. Using panel IV regressions covering the years 1991–2003 and 171 communities and spatial error regressions for the 171 communities in 2003, we find substantial evidence for the income segregation hypothesis in the canton of Zurich.

This chapter is organized as follows. The next section discusses previous theoretical and empirical findings. Section 5.3 gives an introduction to the tax system in Switzerland and in the Canton of Zurich. The subsequent section presents the data. The results of the empirical analysis are discussed in section 5.5. Section 5.6 concludes.

5.2 Theoretical Foundations and Empirical Evidence

Tiebout (1956)'s paper on the efficiency properties of fiscally induced migration has inspired many scholars in different fields of the public finance literature (see Oates, 2006, for an overview). The segregation hypothesis is one of the central propositions in multi-community models in the tradition of Tiebout. Endogenous segregation means that different people choose different locations in equilibrium. While the Tiebout model focuses on heterogeneity of preferences, Ellickson (1971) and Westhoff (1977) focus on income as the main cause of difference. Several mechanisms have been proposed that explain why rich households make different choices than poor households (see Ross and Yinger (1999), for property tax models and Schmidheiny (2002), for income tax models). Similar to the classic Tiebout model, one strand of the literature argues that rich and poor households differ in their preferences for public goods, which in turn will induce income sorting if tax rates, and hence levels of public goods provision, differ among jurisdictions. Another strand of the literature investigates the effect of the income elasticity for housing and the stylized fact that housing prices are typically higher in low tax communities (Epple et al., 1993; Stadelmann and Billon, 2010). If housing is a normal good, housing expenditure becomes less important with increasing income, which means that rich households will benefit more from low taxes than they will lose from high housing

prices. These studies, however, have assumed that tax rates are flat. In two more recent papers, Schmidheiny (2006a) and Schmidheiny and Hodler (2006) draw on the empirical fact that income taxes are progressive and that local jurisdictions can often only set tax levels within a given tax scheme. High income households are then more likely to choose low tax communities, as their tax burden is relatively higher due to the progressiveness of the tax schedule.

Except for the two latter papers, the studies discussed above suggest strict income sorting, which is not observed empirically. De Bartolome and Ross (2003, 2004) solve this issue by introducing commuters and commuting cost into a model of fiscal competition and derive multiple equilibria with both income sorting and income mixing. Schmidheiny (2006b) derives imperfect income segregation in a model where households differ in both income and preferences for housing.

The segregation hypothesis of the Tiebout type models has been challenged by a number of empirical studies. A first strand of research investigates the equilibrium predictions of multi-community models using data on aggregate community characteristics.

Epple and Sieg (1999) and Epple et al. (2001) estimate the household preference parameters of a full equilibrium model where the local income distribution and local policy variables are simultaneously determined. They show that the differing income quantiles across 92 communities in the Boston area can be explained by the model predictions. Using data from US federal states, Bakija and Slemrod (2004) find that wealthy retirees change their state of residence to avoid high state taxes. However, Conway and Rork (2008) do not find this effect. They look at the relationship between tax benefits for the elderly in the US and find no effect of these benefits on the mobility of retirees. Feld and Kirchgässner (2001) regress the share of seven income classes in Swiss cantons and main cities on income tax rates. They find a strong negative relationship between the tax rate and the share of rich households.

Schmidheiny (2006a) studies the locational choice of households in the Swiss metropolitan region of Basel and finds that rich households are substantially more likely to move to low tax communities than poor households.

The study closest to ours is Schmidheiny and Hodler (2006) who simulate a

model of locational choice with progressive taxes at the federal level and a local tax multiplier using income and tax data from the canton of Zurich. Schmidheiny and Hodler (2006)'s study generates two main insights. First, their model, calibrated with real-life values from the canton of Zurich, produces income sorting effects, and second, they find that, due to income sorting, the resulting actual tax progressiveness is lower than intended by the cantonal tax scheme, as high income individuals are more likely to reside in low tax communities, while low income individuals tend to live in high tax communities, which flattens the effective progressiveness of the tax scheme relative to the intended progressiveness.

A different strand of the literature that is highly relevant for our study is the literature on the capitalization of local fiscal policy in property prices. Following the seminal paper of Oates (1969), a large number of studies[5] have found that, among other variables, tax-expenditure packages do capitalize into property prizes. The findings on the extent of capitalization are however mixed. For example, Stadelmann (2009) finds that full capitalization is only possible if the elasticity of supply on the housing market is zero. In all other cases, capitalization will be imperfect, and zero, if supply of housing is perfectly elastic.

In this study, we show that income sorting effects are not only an outcome of a theoretical model, but can also be observed empirically in the case of the Zurich metropolitan area. To our best knowledge, we are the first to study income sorting using panel data from a small[6] and culturally homogeneous region. Hence, we are not only able to make use of cross-sectional variation, as is the case in e.g. Feld and Kirchgässner (2001), but can also take account of variations in tax rates and income shares over time. We also include the house price channel discussed above, which is often ignored in the literature on tax competition and income sorting (an important exception is Feld and Kirchgässner (1997) with their analysis of the Tiebout-Hypothesis within Switzerland). Furthermore, by using data from one single canton we avoid having to take ac-

[5] See e.g Oates (1973), Pollakowski (1973), Yinger et al. (1988), Stull and Stull (1991) and most recently Stadelmann and Billon (2010).

[6] The Canton of Zurich with its 171 communities is only slightly larger than London, UK. The largest distance of a community in the canton to the city of Zurich, which is roughly in the center of the canton, is 36km.

count of factors determining the decision to move that are hard to measure or even not measurable, such as differences in mentality, attachment to the local community, family ties, or differences in the school system.

5.3 Tax Competition in the Canton of Zurich

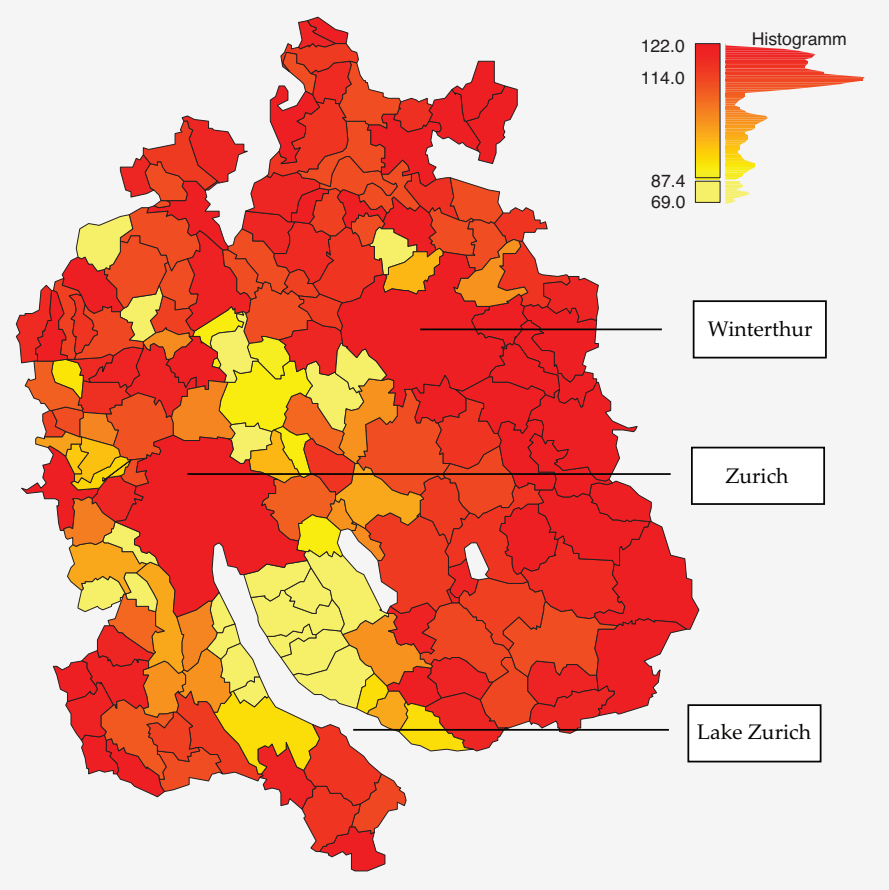
Switzerland has a federalist constitution granting tax autonomy to the sub-federal governments. The Swiss federation consists of 26 states, the so-called cantons. The cantons are divided into roughly 3,000 communities of varying size, population, culture and language. All three state levels finance their expenditures essentially by their own taxes and fees. While the federal government is mainly financed by indirect taxes such as VAT, customs duties and excise dues, the cantons and communities largely rely on direct taxes. Income taxes account for 60 per cent of cantonal and 84 percent of communal tax revenue. However, in addition the federal government levies a highly progressive and profit-yielding income tax which – in return for 17 percent of the revenues – is administrated by the cantons and has an equalizing effect across cantons. Second, a withholding tax on capital income by 35 percent is levied and will be refunded in case of declaration in the income tax form (Feld, 2000).

The cantons organize their tax systems autonomously within the constitutional requirements and legal specifications by the federal harmonization law. For example, they decide upon the level of income and corporate taxes and the degree of tax progression as well as the level of tax exemptions (Feld, 2000).

The individual communities in turn can set a tax multiplier for income and corporate taxes on the cantonal tax tariff. The communal income tax is then the cantonal tax rate multiplied by the communal tax multiplier. Income is taxed at the community of residence, which has led to the grouping of low tax suburban communities around large Swiss cities such as Basel and Zurich. Figure 5.1 displays the distribution of the local income tax multiplier among the 171 local communities of the canton Zurich for the fiscal year 2003.

As Figure 5.1 reveals, the light-colored low-tax communities are sorted around the lake of Zurich, whereas the dark-colored high-tax communities are located

Figure 5.1: *Local income tax burden in the Canton of Zurich, 2003.*

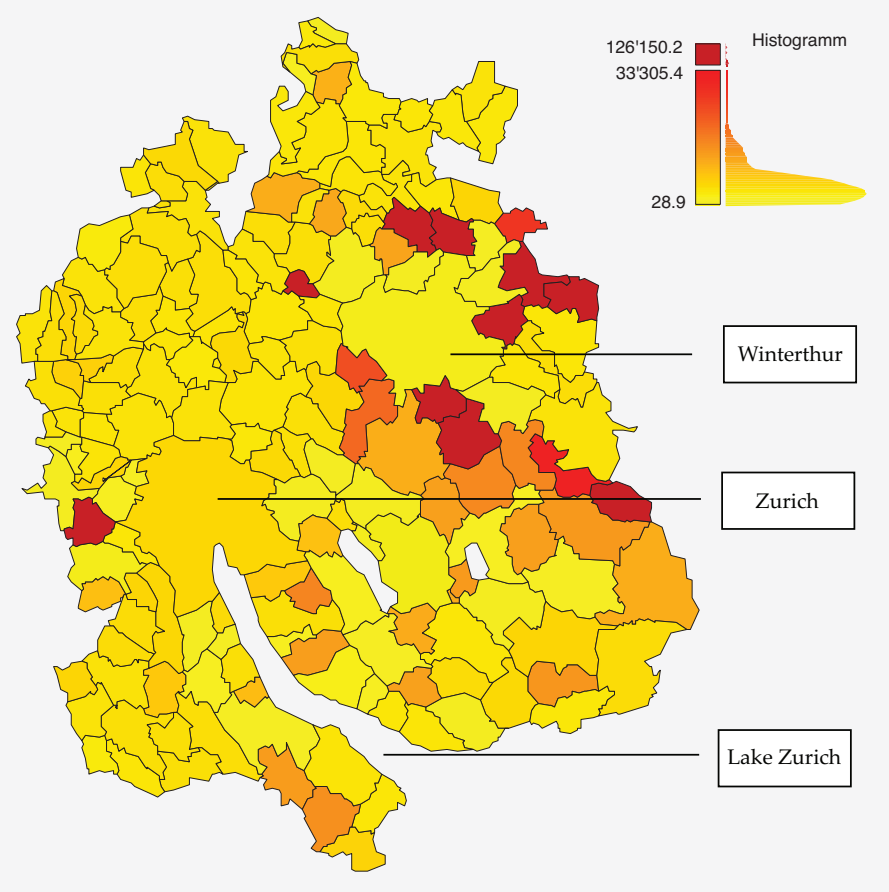


Source: Statistisches Amt des Kantons Zürich (2009b), own graph.

near Winterthur. Compared to Figure 5.1, Figure 5.2 displays the corresponding local tax revenues per tax payer. The picture shows that while some of the high-communities in the eastern part of the canton also generate high tax revenues per tax payer, also some of the low-tax communities near Zurich are able to generate above-average tax revenues per tax payer.

Tax competition in many countries is constrained by tax equalization programs. This is also the case in Switzerland on the federal as well as on the cantonal level (Schaltegger and Frey, 2003). In the canton of Zurich, for example, there are horizontal and vertical tax equalization programs that limit tax competition among communities: First, there is a program that redistributes tax

Figure 5.2: *Local income tax revenues per tax payer in the Canton of Zurich, 2003.*



Source: Statistisches Amt des Kantons Zürich (2009b), own graph.

revenues from the communities with the highest per capita tax bases to those with the lowest. Second, the canton of Zurich subsidizes the communities with the highest tax multipliers. Despite the existence of tax equalization schemes, differences in local taxation are still substantial. In the canton of Zurich, the tax multiplier for the fiscal year 2008 of communities with the highest tax multiplier (137 percent) is almost 1.75 times higher than that of the community with the lowest tax multiplier (79 percent), with an arithmetic mean of 121.4 percent and a median of 127 percent.

5.4 Data and Empirical Strategy

In this study, we use community level data from all 171 communities, grouped in 12 different districts in the Swiss canton of Zurich (for definitions of the variables and summary statistics see Tables 5.5 and 5.6 at the end of this chapter). We choose the canton of Zurich for our analysis, as the canton is the core economic region of Switzerland and attracts the largest share of immigration and intra-Swiss relocation, i.e. the number of locational choices to be done in the canton of Zurich can be assumed to be substantial. Data were collected from the Swiss Federal Office of Statistics, the Swiss Department of Finance, and the Zurich Cantonal Office of Statistics.

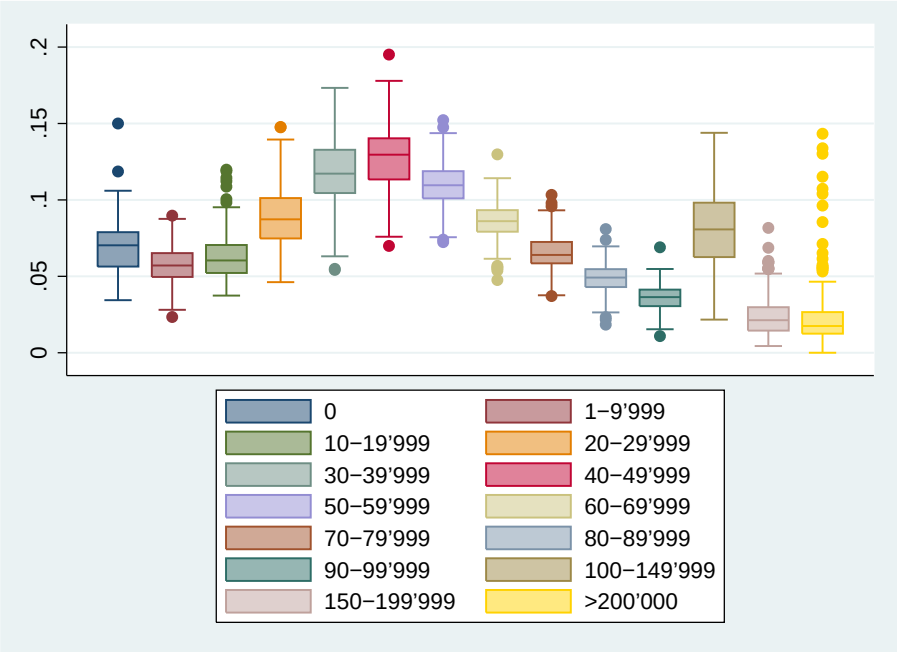
The dependent variables are the shares of different income groups (individual taxable income) in the population of a community. Since the income group ratios vary between zero and one and are therefore censored, they are transformed to log odds. If p is the share of an income group of a community, then $p/(1-p)$ is the corresponding odds, and the logit of the share is the natural logarithm of the odds.

In the original source, there exist 14 classes of individual taxable income, which have been set by the cantonal statistical office. Data on income classes are available for the years 1991, 1995, 1999 and 2003. The box plot in Figure 5.3 shows the average shares of the 14 income classes in the population among the 171 local communities in the Zurich metropolitan area over the whole period of observation.[7] From the box plot, we can also conclude that endogeneity in the form of rich people voting for low tax rates should not bias our empirical results, as the highest income group (>200,000 CHF p.a.) is never in the majority. This is even the case when we sum up the three top income groups (all citizens with incomes above 100,000 CHF p.a.). Hence, we concentrate on the classical Tiebout (1956) effect of voting with one's feet.

As our main explanatory variables, we use the local tax multiplier and the average tax multiplier of the other communities in the same district. If there exists inter-jurisdictional sorting according to the incentives given by tax competition with a progressive tax rate and varying tax multipliers, we expect a

[7] At the time of writing, one Swiss Frank equalled 0.94 US$ and 0.70 EUR.

Figure 5.3: *Income shares for 14 income classes over 171 communities, 2003*



Source: own calculations.

negative impact of the own tax multiplier on the share of high income residents and vice versa for low-income residents. For the average tax multiplier of the neighboring communities, the opposite should appear as long as there is tax competition: The share of high-income residents is positively associated with high tax burdens in neighboring communities and vice versa for low-income residents. An additional variable of main interest, as argued above, is the land price, as fiscal policies might at least partially capitalize into land or property prices. We hence expect land prices to be positively linked to income, as high income earners can afford the higher housing prices caused by partial capitalization of attractive tax schemes. Related to land prices are two of the control variables, airport noise and highway connection. Both variables might not fully capitalize into housing prices (Stadelmann, 2009) and hence need to be controlled for. We expect airport noise to have a negative effect on the share of high income earners. The effect of a highway connection within or close to the community is unclear ex ante, as this might either proxy another source of noise and

pollution, implying a negative effect, or it might imply a positive effect, if high income earners esteem quick access to the highway system.

As further control variables, we use several socio-demographic variables and variables proxying public goods spending and the fiscal stance of the community.

Since the level of publicly provided goods may influence residential decisions (Oates, 1969) we include the following variables to proxy the level of public goods provision in a community: Per capita payments to the cantonal public transport association (which are directly linked to the frequency of e.g. bus and train services), the share of pupils in the population visiting local public schools, and the share of locally practicing physicians.

The fiscal stance of a community is measured by public debt per capita, net wealth of the community and the revenue from (or need of) transfers from the cantonal fiscal equalization scheme. All three variables are expected to be negatively correlated with the shares of high income earners in a community, as a bad fiscal stance implies the risk of future tax increases (see Eichenberger and Stadelmann, 2009). A related variable is the unemployment rate. Ignoring the unemployment rate would bias the results of our analysis of income sorting, as a move from employment to unemployment is an exogenous and in most cases temporary move from a higher income group into the low income group, and not an endogenous change in the share of the low income group caused by the choice of a residential location. In addition, an increase in unemployment lowers the tax base of the community, as does a downturn in the business cycle, which the unemployment rate is a proxy for.

The socio-demographic variables used in this study are the total population and the share of elderly inhabitants (over age 65), the share of young inhabitants (under age 15) and the share of foreigners. Total population is included as we suspect that different income groups might have different preferences concerning the size of the community they live in. The direction of this effect is however ambiguous ex ante, as e.g. wealthier individuals might favor the tranquility of the countryside or the cultural offerings and infrastructure of the city. The shares of elderly and young are included due to their effects on taxable income caused by tax exemptions for pension payments and child allowances.

The share of foreigners needs to be controlled for, as a large part of the foreigners is taxed under a different scheme which imposes identical tax rates on the foreign residents of the canton, independent of the community they live in.

5.5 Empirical Analysis

5.5.1 Panel IV Estimations

In order to test the interjurisdictional sorting hypothesis, we regress the shares of 14 income classes in the local communities on the community's tax multiplier, the average neighboring tax multiplier in the district and the above mentioned control variables. The following 14 equations are estimated:

$$\log\left(\frac{p_{git}}{(1-p_{git})}\right) = \alpha + \beta T_{it} + \gamma Land_{it} + \delta T_{jt} + X_{it} + \epsilon_{it}, \tag{5.1}$$

where the index i refers to the local communities within the territory of the canton of Zurich ($i = 1, \ldots, 171$), j denotes the average local community of the 12 districts within the canton Zurich ($j = 1, \ldots, 12$) and the index t refers to the fiscal year ($t = 1991, 1995, 1999, 2003$). $log\left(p_{git}/\left(1-p_{git}\right)\right)$ represents the share of income class g, $(g = 1, \ldots, 14)$ among all taxpayers in a community i in year t. T_{it} denotes the tax multiplier of community i in year$t$, while T_{jt} is the average tax multiplier of all other communities in the same district as community i. $Land_{it}$ is the price per square meter for building land in community i in year t. α is the constant, while β, δ, and γ are unknown parameters and ϵ it is an error term. X_{it} is a matrix of explanatory variables specific to community i in year t. We add 0.0001 to the percentage shares of the income classes before calculating the log odds, as we would otherwise lose observations taking the value 0.

Testing for endogeneity clearly indicates endogeneity of the tax multipliers and the land prices. To tackle the problem, we use an instrumental variables (IV) method. As instruments we use locational factors, namely the distance to the city of Zurich, a dummy variable if a community has a train station, and dummy variables if the community is situated at Lake Zurich or Lake Greifensee; and a political variable, the share of left wing parties in national

elections, which took place in the years 1991, 1995, 1999 and 2003, which are exactly the years that the income shares data is available for. To take account of the panel structure of the data, we perform fixed effects regressions over the 12 districts. In line with the literature (see e.g. Allers et al., 2001) we expect the tax rate to be the larger, the larger the share of left wing voters is, while we expect political ideology to have no effect on the land price. Vice versa, we expect no effect of train stations on the tax rate, while we do expect an effect on land prices, though the effect is ambiguous ex-ante, as trains cause noise, while train stations and access to public transport may increase land prices. In addition, we expect a positive correlation with the view on Lake Zurich and the Lake Greifensee in the suburban area of Zurich, and a negative correlation with distance to Zurich in the case of land prices, while we have no predictions for the effect of these locational factors on tax multipliers.

Table 5.1: *First stage regression, 1991–2003*

	(1)	(2)		
	Tax multiplier	*Land price*		
Left wing vote share in national elections	0.300***	-0.001		
	[4.03]	[0.92]		
Lake Zurich	-6.358**	0.320***		
	[2.24]	[6.26]		
Distance to Zurich	0.894***	-0.010***		
	[10.93]	[6.61]		
Lake Greifensee	-8.618**	-0.251***		
	[2.19]	[3.56]		
Train station	0.029	0.033**		
	[0.03]	[2.15]		
Constant	91.183***	0.815***		
	[32.35]	[16.08]		
Observations	684	684		
Number of Districts	12	12		
Absolute value of z statistics in brackets	** significant at 10%; ** significant at 5%; *** significant at 1%*			
Summary results for first stage regressions				
	Shea Partial R2	*Partial R2*	*F(5, 663)*	*P-value*
Tax multiplier	0.036	0.094	17.42	0.000
Land price	0.057	0.150	23.69	0.000
Relevance tests				
Anderson-Rubin Wald test	F(5,663)= 10.24	P-val=0.0000		
Anderson-Rubin Wald test	Chi-sq(5)=52.84	P-val=0.0000		
Stock-Wright LM S statistic	Chi-sq(5)=43.77	P-val=0.0000		

The first-stage results in Table 5.1[8] support the relevance of our instruments.

[8]The first stage regressions are identical for all income classes.

We find that taxes are higher in left wing communities, while there is no effect of political ideology on land prices, and no effect of train stations on tax rates, as expected. Tax rates are also found to be lower in communities at Lake Zurich and at Lake Greifensee, while they are higher the further the community is away from the city of Zurich. Land prices are found to be significantly higher in communities situated at Lake Zurich, while they are lower in communities located at Lake Greifensee, and in communities that are further away from the city.

Table 5.2 reports the results of the second stage regressions of our analysis: in line with the prediction of the theory, we find a significantly negative relationship between local tax multipliers and the share of the second and third highest income group. The coefficient of the share of the highest income group is also negative, but marginally insignificant. Furthermore, the negative effect of the tax rates on the shares of high income earners tends to increase with income. On the other hand, we find a significantly positive relationship with the share of low income earners (below CHF 50,000 p.a.). The effect of the tax multipliers of neighboring communities, defined as the average tax multiplier of all other communities in the same district, is even stronger. There, we find a positive and significant relationship between high income earners in community i and the tax rates of all other communities already for individuals with incomes above CHF 60,000. Again, the value of the coefficient tends to increase with the income class. Consequently, we find also a negative relationship for incomes below CHF 50,000. Hence, we do not only find strong evidence for the income sorting hypothesis, as measured by the effect of the own tax multiplier, but we also find that the relative size of the tax multiplier of similar and nearby communities, measured by the average tax multiplier in the same district, exerts an even stronger effect on the choice of residence.

Table 5.2: *Second stage IV regressions, district fixed effects, 1991–2003, 171 communities, 14 income classes, instrumented variables: tax multiplier and land price*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Income class, Swiss Franks p.a.	*0*	*0-9,999*	*10-19,999*	*20-29,999*	*30-39,999*	*40-49,999*	*50-59,999*	*60-69,999*	*70-79,999*	*80-89,999*	*90-99,999*	*100-149,999*	*150-199,999*	*¿200,000*
Tax Multiplier	0.019**	0.013**	0.007	0.007	0.013***	0.008**	0.001	-0.003	0.006	0.001	-0.008	-0.016*	-0.037***	-0.029
	[2.42]	[2.52]	[1.39]	[1.02]	[2.79]	[2.28]	[0.21]	[0.92]	[1.27]	[0.17]	[1.06]	[1.68]	[2.65]	[1.26]
Land price	0.504*	0.169	-0.551***	-1.131***	-0.657***	-0.390***	-0.181	0.066	0.541***	0.659***	0.916***	1.509***	1.706***	3.577***
	[1.71]	[0.82]	[2.77]	[4.22]	[3.46]	[2.79]	[1.47]	[0.54]	[2.95]	[3.17]	[3.19]	[3.81]	[3.09]	[3.79]
Neighbor tax, district average	-0.009**	-0.004*	-0.007***	-0.014***	-0.010***	-0.006***	0.000	0.003**	0.003	0.003	0.011***	0.021***	0.032***	0.049***
	[2.20]	[1.73]	[2.65]	[4.09]	[4.03]	[2.93]	[0.07]	[1.98]	[1.43]	[0.94]	[2.60]	[4.22]	[4.18]	[4.20]
Airport noise	-0.090*	-0.043	-0.015	-0.012	0.034	0.088***	0.082***	0.068***	0.016	0.033	0.000	-0.075	-0.217***	-0.341***
	[1.83]	[1.35]	[0.56]	[0.33]	[1.14]	[4.02]	[4.44]	[3.71]	[0.48]	[1.22]	[0.01]	[1.41]	[2.72]	[3.00]
Highway Access	1.414*	0.811	2.479***	2.472***	0.695	-0.555	-0.906***	-1.132***	-1.945***	-2.580***	-2.774***	-3.414***	-3.847**	-3.952*
	[1.74]	[1.59]	[4.88]	[3.83]	[1.47]	[1.50]	[2.99]	[3.81]	[4.29]	[4.77]	[3.83]	[3.54]	[2.43]	[1.78]
Share of elderly	-4.397***	-1.827***	0.774	1.541**	-0.211	-0.574	0.706	0.419	-1.833***	-1.447*	-1.540	-1.444	-1.453	-3.825
	[3.95]	[2.59]	[1.14]	[2.04]	[0.38]	[1.08]	[1.50]	[0.87]	[2.83]	[1.85]	[1.11]	[1.16]	[0.68]	[1.28]
Share of young	-2.773	-0.770	-0.368	-0.899	0.475	0.136	2.206***	1.271	0.164	0.323	3.811	-1.778	-0.988	-9.962**
	[1.45]	[0.65]	[0.35]	[0.77]	[0.43]	[0.16]	[2.85]	[1.43]	[0.16]	[0.29]	[1.08]	[0.98]	[0.23]	[2.18]
Population	-1.378	-1.200**	-0.155	-1.464***	-1.706***	-0.691*	-0.457	-0.232	-0.824	-0.124	1.539	3.108***	1.713	4.861**
	[1.64]	[2.08]	[0.31]	[2.66]	[4.30]	[1.93]	[1.30]	[0.46]	[1.27]	[0.17]	[1.60]	[3.58]	[0.77]	[2.02]
Share of foreigners	-17.999	-33.385*	-24.931	1.004	-15.218	-9.414	3.969	14.330	-14.846	9.233	27.480	32.582	56.240	97.672
	[0.64]	[1.72]	[1.36]	[0.05]	[0.98]	[0.68]	[0.34]	[1.27]	[0.97]	[0.51]	[1.04]	[1.04]	[1.19]	[1.36]
Share of pupils	0.004	0.000	0.001	0.004*	0.006***	0.003**	0.001	0.002	0.001	-0.004*	-0.005*	-0.010***	-0.013**	-0.007
	[1.49]	[0.24]	[0.83]	[1.68]	[3.62]	[2.09]	[0.85]	[1.38]	[0.58]	[1.85]	[1.92]	[2.96]	[2.44]	[0.91]
Contributions to public transport, p.c.	-0.003**	0.000	0.003***	0.005***	0.002**	0.001	0.001	-0.001	-0.003***	-0.003***	-0.004**	-0.006**	-0.006*	-0.015**
	[2.06]	[0.44]	[2.84]	[2.58]	[1.96]	[1.54]	[1.12]	[1.06]	[2.59]	[2.67]	[2.28]	[2.45]	[1.94]	[2.32]
Physicians, p.c.	-0.017	-0.055***	-0.025***	-0.047***	-0.017**	0.019***	0.038***	0.022***	0.028***	0.024**	0.033***	0.017	-0.041	-0.058
	[1.07]	[5.48]	[2.84]	[3.98]	[2.02]	[3.03]	[6.50]	[3.35]	[3.17]	[2.37]	[2.73]	[1.01]	[1.54]	[1.59]
Unemployment rate	8.294	4.582	-1.450	-2.668	-0.650	0.815	0.135	3.550	4.546	11.072**	-11.613	-1.442	-6.171	-9.097
	[1.24]	[1.00]	[0.31]	[0.61]	[0.20]	[0.25]	[0.05]	[1.17]	[0.94]	[2.20]	[1.49]	[0.23]	[0.54]	[0.63]
Revenue from fiscal equalization, p.c.	-0.113***	-0.030	-0.022	-0.012	0.009	0.015	0.037***	0.040***	0.015	0.032	-0.034	0.005	0.037	0.059
	[3.55]	[1.43]	[1.09]	[0.47]	[0.48]	[1.01]	[2.95]	[3.15]	[0.79]	[1.42]	[0.77]	[0.15]	[0.67]	[0.72]
Debt, p.c.	-0.140	0.038	0.264***	0.321**	0.229***	0.083	0.008	-0.181***	-0.149*	-0.445***	-0.402*	-0.568***	-0.689***	-1.136***
	[0.92]	[0.41]	[2.64]	[2.52]	[2.71]	[1.25]	[0.15]	[2.61]	[1.68]	[4.87]	[1.70]	[3.34]	[2.62]	[2.67]
Community net wealth, p.c.	8.575	6.970	-7.591	2.681	-0.421	1.922	2.069	2.984	4.463	10.038*	2.554	-1.901	16.228	-23.479
	[1.14]	[1.21]	[1.56]	[0.49]	[0.10]	[0.52]	[0.49]	[0.75]	[0.91]	[1.71]	[0.36]	[0.21]	[0.79]	[1.08]
Time trend	0.314***	0.066***	-0.171***	-0.159***	-0.159***	-0.107***	-0.048***	0.004	0.052***	0.106***	0.162***	0.285***	0.423***	0.522***
	[12.40]	[3.96]	[11.08]	[8.71]	[11.55]	[9.69]	[4.79]	[0.41]	[3.35]	[5.74]	[6.38]	[10.00]	[9.99]	[7.56]
Constant	-4.290***	-3.632***	-2.342***	-0.958	-1.648***	-1.632***	-2.124***	-2.478***	-3.613***	-3.417***	-4.086***	-3.799***	-4.235***	-7.655***
	[5.08]	[6.34]	[4.33]	[1.37]	[3.21]	[4.19]	[6.24]	[7.57]	[7.33]	[6.22]	[5.21]	[3.72]	[2.76]	[3.11]
Observations	684	684	684	684	684	684	684	684	684	684	684	684	684	684
Robust z statistics in brackets	** significant at 10%; ** significant at 5%; *** significant at 1%*													

Concerning land prices, we also find our predictions about direction and significance of the effect confirmed. Unsurprisingly, high income earners tend to live in communities with high land prices (columns 9 to 14), while the opposite is the case for low income earners (columns 3 to 6). The fact that both land prices and tax rates exert a significant effect on the choice of residence leads us to the conclusion that the capitalization of tax rates in house prices is imperfect.

Turning to our controlling variables, we first have a look at socio-demographic variables. For retirees, we find that the share of people above the age of 65 decreases the share of people with high taxable income. The reason for this effect is clear: pensions are lower than labor income, and they are only partially taxable. A similar reason explains the (less significant) positive effect of the share of young people below the age of 15 on middle income shares, and a negative one on the top income shares. Children reduce the taxable income (but not the disposable income) of their parents due to child allowances. Concerning the absolute size of the population, we find a slight tendency of rich people to prefer smaller communities, while poorer people tend to live in larger communities. The share of foreigners is not found to be significant. This might be due to the fact that the Zurich area attracts not only low-skilled immigrants, but also large amounts of high-skilled immigrants.

For the variables that proxy public goods provision, we find that low income individuals seem to esteem public transport more than high income earners, which is in line with the theory which suggests that poorer people prefer higher levels of public goods provision. Similarly, poorer communities have larger shares of pupils in locals schools than rich communities, where the effect is the opposite. Medium income earners are found to prefer communities with a larger share of local physicians, while the effect is negative at the low end of the income distribution, and insignificant at the top end.

High income earners are also found to avoid high debt communities, and hence future tax increases, while the opposite is the case for low income earners. Community net wealth, which also includes non-financial assets of a community, is found to have hardly any effect on residential choices. The income distribution is also not significantly influenced by the changes in the unemployment rate.

Airport noise seems to decrease the share of high income earners and to increase the share of the medium income earners. Highway access, which also proxies noise from highways, exerts a significantly negative effect on the income shares above CHF 50,000.

5.5.2 Robustness Check

As a robustness check, we leave out all variables concerning public finances except for the tax rates and public debt, all variables that proxy the amount of public goods provision including highway access, and all socio-demographic variables except for the unemployment rate, population size and the share of foreigners in the second stage estimation. As Table 5.3 shows, our main results (see Table 5.2) remain robust to this drastic change in the regression setup. Again, we find a community's own tax multiplier to be positively related to the shares of low income earners, and negatively related to the share of high income earners. The reverse result holds for the tax rates of the district neighbors: A higher average tax rate in neighboring communities is associated with lower share of low income earners in the community, and a higher share of high income earners. The effect of land prices on the choice of residence is also unaltered, as are the effects of the remaining controlling variables, except for the unemployment rate, which is now found to exert a significant effect on the income distribution. The unemployment rate is found to increase the share of people with high incomes, and to decrease the share of people with low taxable income. At first sight, this seems counterintuitive. However, this can be easily explained, as unemployment moves people either into the zero taxable income group or completely out of the statistics. As low income earners are more likely to be affected by unemployment than high income earners, an increase in unemployment decreases the share of low taxable income earners in a community and increases the share of high income earners.

Table 5.3: *Second stage panel IV regression, district fixed effects, 1991–2003, 171 communities, 14 income classes, instrumented variables: tax multiplier and land price, parsimonious model*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Income class, Swiss Franks p.a.	*0*	*0-9,999*	*10-19,999*	*20-29,999*	*30-39,999*	*40-49,999*	*50-59,999*	*60-69,999*	*70-79,999*	*80-89,999*	*90-99,999*	*100-149,999*	*150-199,999*	*¿200,000*
Tax Multiplier	0.020**	0.009**	0.013***	0.009*	0.011***	0.005	0.000	-0.004	0.000	-0.006	-0.004	-0.017**	-0.037***	-0.021
	[2.49]	[2.20]	[2.99]	[1.71]	[2.75]	[1.40]	[0.10]	[1.59]	[0.09]	[1.25]	[0.59]	[2.06]	[3.05]	[1.01]
Land price	1.157***	0.259	-0.344	-0.963***	-0.652***	-0.503***	-0.352**	-0.076	0.412**	0.427*	1.003***	1.428***	1.768***	4.270***
	[2.76]	[1.29]	[1.62]	[3.56]	[3.24]	[3.22]	[2.57]	[0.57]	[2.16]	[1.94]	[2.97]	[3.37]	[2.85]	[3.69]
Neighbor tax, district average	-0.008*	-0.003	-0.009***	-0.015***	-0.010***	-0.005**	0.000	0.004**	0.005**	0.005*	0.011**	0.022***	0.034***	0.048***
	[1.72]	[1.25]	[3.74]	[4.78]	[4.09]	[2.34]	[0.08]	[2.01]	[2.30]	[1.92]	[2.08]	[4.69]	[4.38]	[4.09]
Airport noise	-0.088	-0.041	-0.038	-0.039	0.040	0.101***	0.095***	0.082***	0.053*	0.065***	0.019	-0.049	-0.174**	-0.259**
	[1.64]	[1.40]	[1.39]	[1.13]	[1.43]	[4.67]	[4.99]	[4.63]	[1.76]	[2.61]	[0.48]	[0.96]	[2.23]	[2.19]
Share of foreigners	0.005	-0.001	0.001	0.002	0.006***	0.003**	0.002	0.002*	0.002	-0.003*	-0.003	-0.009***	-0.012**	-0.003
	[1.53]	[0.51]	[0.69]	[1.24]	[4.20]	[2.33]	[1.30]	[1.87]	[1.38]	[1.71]	[1.02]	[2.81]	[2.27]	[0.35]
Population	-0.005**	0.000	0.003***	0.005***	0.003**	0.002*	0.001	0.000	-0.003***	-0.003***	-0.005***	-0.007***	-0.007**	-0.017**
	[1.98]	[0.39]	[3.05]	[2.92]	[2.18]	[1.77]	[1.20]	[0.70]	[2.89]	[2.75]	[2.69]	[2.68]	[2.20]	[2.31]
Unemployment rate	-0.012	-0.053***	-0.025***	-0.045***	-0.016*	0.020***	0.036***	0.021***	0.028***	0.025**	0.027**	0.016	-0.039	-0.048
	[0.63]	[5.39]	[2.88]	[3.87]	[1.91]	[2.91]	[5.42]	[3.08]	[3.46]	[2.54]	[2.06]	[0.98]	[1.41]	[1.15]
Debt, p.c.	-0.308**	-0.048	0.362***	0.269***	0.096	0.004	-0.054	-0.239***	-0.297***	-0.548***	-0.439**	-0.437***	-0.782***	-1.032**
	[1.99]	[0.59]	[4.36]	[2.85]	[1.37]	[0.08]	[0.95]	[3.59]	[3.63]	[6.09]	[2.21]	[3.02]	[2.75]	[2.43]
Time trend	0.392***	0.097***	-0.148***	-0.130***	-0.142***	-0.108***	-0.064***	-0.012	0.048***	0.087***	0.141***	0.241***	0.395***	0.501***
	[12.12]	[6.18]	[9.10]	[6.33]	[9.68]	[8.76]	[5.24]	[0.96]	[2.79]	[4.46]	[4.75]	[7.17]	[7.09]	[5.54]
Constant	-5.760***	-3.756***	-2.508***	-0.778	-1.425***	-1.407***	-1.763***	-2.221***	-3.625***	-3.250***	-4.880***	-4.399***	-5.007***	-10.237***
	[5.16]	[6.91]	[4.43]	[1.17]	[2.79]	[3.38]	[4.83]	[6.30]	[7.56]	[5.92]	[5.91]	[4.17]	[3.08]	[3.55]
Observations	684	684	684	684	684	684	684	684	684	684	684	684	684	684
Robust z statistics in brackets	** significant at 10%; ** significant at 5%; *** significant at 1%*													

5.5.3 Spatial Correlation

In the estimations presented in the above section, we tackled the endogeneity problem arising from the fact that land prices and tax rates are endogenous to the income of a community's inhabitants. In this section, we additionally address two other issues. The first is the possibility that a community's income distribution is endogenous to the income distribution of neighboring communities, which may be the case because of clustering effects caused by e.g. an increased attractiveness of community A due to a positive socio-demographical change in the neighboring community B. A second related issue is spatial correlation of the error terms which is caused by omitted spatial variables.

For our analysis, we use two different spatial weighting matrices. First, we employ the inverse of the distance between the communities, and second, we use a matrix containing a 1 if the communities share a common border and 0 otherwise. When computing the weighting scheme, the matrices are row standardized.

Using the standard specification tests as discussed in Anselin et al. (1996), we find that we can exclude a spatial lag model. The tests indicate however the existence of spatial correlation in the error term. This only holds when we apply the inverse distance matrix as spatial weights. Using the matrix considering only neighboring communities, we find no evidence for spatial correlation. A first conclusion is thus that while individuals do care about tax rates of nearby communities (within the same district, see Section 5.5) in choosing their place of residence, there is no specific weight on the tax rates of directly neighboring communities. As the tests however suggest spatial dependency in the error terms, we estimate a spatial error model as described in Anselin (1988) and Anselin and Bera (1998).

The equations are estimated using Maximum Likelihood and take the following form:

$$\begin{aligned} \log\left(\frac{p_{gi}}{(1-p_{gi})}\right) &= \alpha + \beta T_{it} + \gamma Land_{it} + \delta T_{jt} + \xi X_i + \epsilon_i, \qquad (5.2) \\ \text{with } \epsilon &= \lambda W\epsilon + u, \end{aligned}$$

where $\log\left(p_{gi}/\left(1-p_{gi}\right)\right)$ are the log odds of the respective income share g. ϵ is a vector of spatially autocorrelated error terms, u is a vector of i.i.d. errors. T_i is the tax multiplier of community i, T_{jt} the average tax multiplier of the other communities in the same district as community i, and $Land_{it}$ is the price for building land per square meter in community i in year t. X_i is a vector of observations of the other explanatory variables, W is the spatial weights matrix and λ, β, γ, ξ and δ are parameters.

We extend the spatial error model proposed by Anselin (1988) and Anselin and Bera (1998) to tackle the endogeneity of tax multipliers and land prices and instrument these variables using the same IV first-step estimations as in Section 5.5.

The results are presented in Table 5.4. The evidence for the income sorting hypothesis is even stronger in this setup, as our main finding on the relationship between income tax multipliers and the shares of the income classes is not only robust to this change in the setup, but the significance of this effect increases considerably. We find the tax multiplier to have a negative impact on the shares of people with incomes above 60,000 CHF. Furthermore, for the higher income classes the importance of the tax rate in the choice of location seems to increase, as indicated by the (absolute) increase of the coefficient from middle to high income classes. The effects of the average tax multipliers of the communities in the same district, as well as the effect of the land price, lose significance in this setup, as spatial correlation is now controlled for. The findings on the control variables remain qualitatively robust, except for the public debt, which is now insignificant for most of the income classes.

Table 5.4: *Spatial error regressions, 2003, 171 communities, 14 income classes.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	0	*0-9,999*	*10-19,999*	*20-29,999*	*30-39,999*	*40-49,999*	*50-59,999*	*60-69,999*	*70-79,999*	*80-89,999*	*90-99,999*	*100-149,999*	*150-199,999*	*¿200,000*
Tax Multiplier	0.003	0.003*	0.009***	0.013***	0.010***	0.007***	0.002**	-0.002*	-0.004***	-0.007***	-0.009***	-0.015***	-0.024***	-0.029***
	[1.29]	[1.82]	[5.74]	[8.29]	[6.92]	[6.76]	[2.20]	[1.89]	[3.58]	[4.84]	[6.32]	[7.59]	[8.24]	[7.16]
Land price	0.100	-0.019	-0.009	-0.102	-0.173***	-0.169***	-0.122***	-0.097**	-0.061	0.057	0.092	0.217**	0.416***	0.740***
	[1.09]	[0.30]	[0.15]	[1.12]	[2.87]	[4.04]	[2.76]	[2.01]	[0.97]	[0.87]	[1.27]	[2.03]	[3.16]	[3.61]
Neighbor tax, district average	0.001	-0.003*	-0.002	-0.001	0.000	0.000	-0.001	0.002	0.001	0.000	0.002	0.002	-0.004	0.002
	[0.34]	[1.86]	[1.29]	[0.51]	[0.28]	[0.20]	[0.42]	[1.41]	[0.71]	[0.20]	[1.18]	[0.71]	[0.98]	[0.44]
Airport noise	-0.134*	-0.115*	-0.031	0.025	0.054	0.126***	0.080**	0.071**	0.034	-0.031	0.010	-0.053	-0.193*	-0.220**
	[1.91]	[1.72]	[0.81]	[0.58]	[1.27]	[4.27]	[2.43]	[2.20]	[1.01]	[0.83]	[0.21]	[0.83]	[1.89]	[2.19]
Highway Access	-0.145***	0.026	0.027	0.015	0.033	0.001	0.016	0.007	0.000	0.076**	-0.040	0.022	-0.017	0.017
	[3.29]	[0.58]	[0.83]	[0.41]	[1.11]	[0.03]	[0.68]	[0.31]	[0.01]	[2.31]	[1.02]	[0.44]	[0.21]	[0.16]
Share of elderly	0.444	0.214	1.458*	3.002***	0.790	-0.536	-0.574	-1.117*	-1.154*	-1.678*	-2.175**	-2.545**	-2.345	1.304
	[0.42]	[0.22]	[1.87]	[3.49]	[1.24]	[0.78]	[0.98]	[1.95]	[1.77]	[1.74]	[2.45]	[2.51]	[1.51]	[0.45]
Share of young	-1.369	1.463	0.218	-1.008	-0.474	-2.524**	-1.308	0.639	-0.160	1.494	0.562	1.599	2.728	1.834
	[0.77]	[0.95]	[0.15]	[0.71]	[0.45]	[2.22]	[1.54]	[0.56]	[0.14]	[1.03]	[0.38]	[0.82]	[0.92]	[0.48]
Population	-5.131	-7.271	1.867	5.506	2.315	7.813	9.130**	-0.950	4.534	1.364	-0.880	-14.317*	-29.995***	-6.789
	[0.80]	[1.14]	[0.30]	[1.11]	[0.69]	[1.58]	[2.48]	[0.23]	[0.82]	[0.18]	[0.17]	[1.91]	[2.73]	[0.27]
Share of foreigners	-0.255	-0.548	-0.345	-1.547**	-0.319	0.130	0.158	-2.047***	-0.654	1.121	0.470	0.941	4.203***	2.666
	[0.27]	[0.48]	[0.49]	[1.96]	[0.38]	[0.25]	[0.34]	[2.93]	[0.99]	[1.60]	[0.48]	[0.73]	[2.86]	[1.40]
Share of pupils	19.971	-2.036	-31.303	-29.027	-12.212	1.307	-4.255	9.336	2.829	14.272	34.236*	15.177	32.571	28.107
	[0.73]	[0.09]	[1.54]	[1.63]	[0.77]	[0.08]	[0.36]	[0.67]	[0.16]	[0.73]	[1.67]	[0.51]	[0.79]	[0.39]
Contributions to public transport, p.c.	0.008	0.005	0.000	0.005	0.008**	0.004	0.000	-0.001	0.000	0.001	-0.003	-0.013**	-0.015	-0.013
	[1.51]	[0.94]	[0.11]	[1.19]	[2.35]	[1.32]	[0.14]	[0.44]	[0.12]	[0.36]	[0.69]	[2.45]	[1.43]	[1.19]
Physicians, p.c.	-0.004	-0.003	0.017***	0.006	0.000	-0.001	0.002	0.002	-0.004	-0.011**	-0.004	-0.008	-0.017*	-0.005
	[0.58]	[0.57]	[3.42]	[1.50]	[0.08]	[0.38]	[0.64]	[0.52]	[1.08]	[2.57]	[0.79]	[1.36]	[1.76]	[0.38]
Unemployment rate	-0.041	-0.064**	-0.001	-0.033	-0.015	0.003	0.035**	0.025	0.004	-0.018	-0.004	0.027	0.027	-0.039
	[1.20]	[1.96]	[0.04]	[1.40]	[0.68]	[0.22]	[2.12]	[1.33]	[0.22]	[0.71]	[0.15]	[0.76]	[0.55]	[0.66]
Revenue from fiscal equalization, p.c.	3.888	-5.820	-4.427	-0.600	-5.711	-1.193	0.435	4.200	8.491***	1.544	-5.554	-0.344	-6.660	7.525
	[0.52]	[1.25]	[0.68]	[0.19]	[1.55]	[0.47]	[0.15]	[1.16]	[4.24]	[0.43]	[1.04]	[0.06]	[0.48]	[0.88]
Debt, p.c.	-0.042	-0.106	0.268*	0.188	-0.002	0.000	-0.038	-0.003	-0.178	-0.428***	-0.071	-0.235	-0.612**	-0.248
	[0.25]	[0.69]	[1.76]	[1.59]	[0.02]	[0.00]	[0.45]	[0.03]	[1.59]	[3.30]	[0.43]	[1.58]	[2.46]	[0.59]
Community net wealth, p.c.	-2.071	9.094	-11.864*	3.321	-6.504	-0.621	-5.454	-7.179	-3.113	8.661	25.683***	13.655	10.432	0.731
	[0.28]	[1.13]	[1.95]	[0.69]	[1.13]	[0.14]	[1.08]	[1.45]	[0.50]	[1.57]	[2.85]	[1.22]	[0.94]	[0.04]
Constant	-2.671***	-2.666***	-3.743***	-3.901***	-3.172***	-2.417***	-2.238***	-2.255***	-2.167***	-2.264***	-2.411***	-0.617	-0.330	-1.422
	[5.76]	[6.08]	[9.86]	[10.03]	[10.76]	[9.09]	[9.23]	[6.71]	[7.58]	[5.62]	[6.05]	[1.18]	[0.43]	[1.18]
Observations	171	171	171	171	171	171	171	171	171	171	171	171	171	171
Robust z statistics in brackets	** significant at 10%; ** significant at 5%; *** significant at 1%*													

5.6 Conclusion

In this chapter, we have investigated the empirical validity of the inter-jurisdictional income sorting hypothesis, which is a core result of the theoretical tax competition literature. It states that in a system with fiscal federalism, individuals differing in income and preferences for public goods and/or housing will self-select into different communities, where communities differ in income tax rates. This self-selection process will then lead to substantial differences in the income distributions between the communities.

In our empirical analysis covering 171 communities over the share of 14 income classes on the whole population in the Swiss canton of Zurich, we have found ample evidence for the income segregation hypothesis. We provide empirical evidence that high income earners are more likely to reside in low tax communities especially if neighboring communities in the same district have higher taxes. The opposite holds for low-income earners: they are more likely to settle in high tax communities.

While the tax competition literature in the Tiebout tradition suggests that this kind of income sorting enhances overall efficiency in the economy, the literature on education highlights also the negative aspects of income sorting.[9] In general, advocates argue that fiscal federalism allows tailoring public goods towards the specific needs of local residents, enhances efficiency while reducing inefficiency in public administration due to the pressure created by systems competition. In addition, the more homogenous a local community, the more targeted fiscal equalization schemes across the canton can work and the more efficient the redistributive capacity of such a transfer program will be. Critics argue on the other hand, that the opportunities of an individual are highly correlated with his or her neighborhood and social background. An uneven distribution of high and low income individuals between communities is thus likely to reduce human capital accumulation and social mobility, and to produce persistent inequality and poverty traps. These social problems might be enforced by increasing worldwide economic integration, as the literature suggests that economic globalization leads to an increasing wage gap between low-skilled

[9] See e.g. Butler and Robson (2003) and Leventhal and Brooks-Gunn (2003).

and high-skilled workers, and to an increasing taxation of the relatively more immobile factor of production, namely labor.

In combination with the results of the income sorting literature, increasing globalization can be expected to lead to an increase in income sorting in countries with income tax competition at the local level, yielding new challenges for both politicians and researchers.

5.7 Tables

Table 5.5: *Variable descriptions*

Variable	*Description*	*Source*
Taxable Income Class	Percentage share of taxpayers in an income class (taxable income)	Statistisches Amt des Kantons Zürich (1993, 1997, 2001, 2005)
Tax Multiplier	Tax multiplier determining local tax rates, percentage of cantonal tax rate	Statistisches Amt des Kantons Zürich (2009b)
Land price	Mean price per square meter in Swiss Francs	Statistisches Amt des Kantons Zürich (2009b)
Neighbor tax, district average	Average of tax multipliers of all other communities in the district	Statistisches Amt des Kantons Zürich (2009b)
Left wing vote share in national elections	Sum of vote shares of left wing parties (SP, GP, EVP) in national elections	Statistisches Amt des Kantons Zürich (2009c)
Airport noise	Dummy for communities that need extra noise protection as determined by the Zurich airport authority	`http://www.unique.ch/dokumente/las_08_zrh04_gwk_esii_v1.jpg`
Highway access	Dummy for highway access within 5km	`http://www.gis.zh.ch`
Lake Zurich	Location at Lake Zurich	`http://www.gis.zh.ch`
Lake Greifensee	Location at Lake Greifensee	`http://www.gis.zh.ch`
Distance to Zurich	Distance to the city of Zurich, linear distance	Own calculations
Train station	Dummy for train station in the community	Zurich transport authority, ZVV
Share of elderly	Share of inhabitants over 65 years of age	Statistisches Amt des Kantons Zürich (2009a)
Share of young	Share of inhabitants below age 15	Statistisches Amt des Kantons Zürich (2009a)
Share of foreigners	Share of foreigners in total population	Statistisches Amt des Kantons Zürich (2009a)
Population	Absolute number of population	Statistisches Amt des Kantons Zürich (2009a)
Share of pupils	Share of pupils pre-school, elementary school, high school and vocational education in total population	Statistisches Amt des Kantons Zürich (2009a)
Contributions to public transport, p.c.	Per capita transfers to the Zurich public transport authority (ZVV)	SStatistisches Amt des Kantons Zürich (2009a)
Physicians, p.c.	Number of physicians per capita in a community	Statistisches Amt des Kantons Zürich (2009a)
Unemployment rate	Unemployment rate, percentage	Bundesamt für Statistik (2009)
Revenue from fiscal equalization, p.c.	Per capita transfers received from the cantonal fiscal equalization scheme	Statistisches Amt des Kantons Zürich (2009b)
Debt, p.c.	Public debt per capita, Swiss Francs	Statistisches Amt des Kantons Zürich (2009b)
Community net wealth, p.c.	Public net wealth per capita, Swiss Francs	Statistisches Amt des Kantons Zürich (2009b)

Table 5.6: *Summary statistics*

	Obs.	*Mean*	*Std. Dev.*	*Min.*	*Max.*
Taxable Income, log odds					
0	684	-2.94	0.42	-4.80	-1.73
0–9,999	684	-2.82	0.24	-3.80	-2.20
10–19,999	684	-2.56	0.28	-3.25	-1.51
20–29,999	684	-2.23	0.28	-3.03	-1.39
30–39,999	684	-1.92	0.24	-2.86	-1.36
40–49,999	684	-1.88	0.19	-2.59	-1.23
50–59,999	684	-2.09	0.17	-2.94	-1.66
60–69,999	684	-2.39	0.17	-3.20	-1.90
70–79,999	684	-2.73	0.22	-4.03	-2.13
80–89,999	684	-3.08	0.27	-4.72	-2.43
90–99,999	684	-3.43	0.40	-9.21	-2.60
100–149,999	684	-2.63	0.43	-4.54	-1.78
150–199,999	684	-4.03	0.75	-9.21	-2.42
>200,000	684	-4.11	0.94	-9.21	-1.79
Tax Multiplier, per cent	684	113.87	13.33	69.00	131.00
Land price	684	0.61	0.26	0.15	3.27
Neighbor tax, district average	684	113.84	8.28	88.45	130.00
Left wing vote share (percentage) in national elections	684	29.09	5.96	14.30	50.00
Airport noise	684	0.11	0.31	0.00	1.00
Highway access	684	0.37	0.48	0.00	1.00
Lake Zurich	684	0.10	0.30	0.00	1.00
Distance to Zurich	684	17.80	7.66	0.00	36.00
Lake Greifensee	684	0.04	0.20	0.00	1.00
Train station	684	0.51	0.50	0.00	1.00
Share of elderly	684	0.12	0.03	0.04	0.24
Share of young	684	0.19	0.03	0.11	0.31
Share of foreigners	684	12.94	7.42	1.00	42.10
Population, thousands	684	6.99	26.91	0.23	350.82
Share of pupils	684	0.02	0.01	0.00	0.08
Contributions to public transport, thousands of CHF, p.c.	684	0.03	0.03	0.00	0.22
Physicians, p.c.	684	0.00	0.00	0.00	0.00
Unemployment rate	684	1.90	1.36	0.00	7.50
Revenue from fiscal equalization, thousands of CHF, p.c.	684	0.60	2.23	0.00	34.94
Debt, thousands of CHF, p.c.	684	0.38	0.15	-0.56	1.24
Community net wealth, thousands of CHF, p.c.	684	0.00	0.00	-0.02	0.02

Note: 14 income classes; explanatory variables based on estimation sample for income class 10.

Table 5.7: *First stage regressions, 1991–2003, 171 communities, dependent variable: tax multiplier*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Income class, Swiss Franks p.a.	*0*	*0-9,999*	*10-19,999*	*20-29,999*	*30-39,999*	*40-49,999*	*50-59,999*	*60-69,999*	*70-79,999*	*80-89,999*	*90-99,999*	*100-149,999*	*150-199,999*	*¿200,000*
Left wing vote share	0.300***	0.300***	0.300***	0.300***	0.300***	0.300***	0.300***	0.300***	0.300***	0.300***	0.303***	0.300***	0.303***	0.296***
	[4.03]	[4.03]	[4.03]	[4.03]	[4.03]	[4.03]	[4.03]	[4.03]	[4.03]	[4.03]	[4.06]	[4.03]	[4.06]	[3.95]
Lake Zurich	-6.358**	-6.358**	-6.358**	-6.358**	-6.358**	-6.358**	-6.358**	-6.358**	-6.358**	-6.358**	-6.360**	-6.358**	-6.342**	-6.313**
	[2.24]	[2.24]	[2.24]	[2.24]	[2.24]	[2.24]	[2.24]	[2.24]	[2.24]	[2.24]	[2.24]	[2.24]	[2.23]	[2.22]
Distance to Zurich	0.894***	0.894***	0.894***	0.894***	0.894***	0.894***	0.894***	0.894***	0.894***	0.894***	0.895***	0.894***	0.897***	0.900***
	[10.93]	[10.93]	[10.93]	[10.93]	[10.93]	[10.93]	[10.93]	[10.93]	[10.93]	[10.93]	[10.94]	[10.93]	[10.89]	[10.95]
Lake Greifensee	-8.618**	-8.618**	-8.618**	-8.618**	-8.618**	-8.618**	-8.618**	-8.618**	-8.618**	-8.618**	-8.621**	-8.618**	-8.624**	-8.615**
	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]	[2.19]
Train Station	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.029	0.034	0.029	0.017	0.021
	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]	[0.04]	[0.03]	[0.02]	[0.02]
Constant	91.183***	91.183***	91.183***	91.183***	91.183***	91.183***	91.183***	91.183***	91.183***	91.183***	91.068***	91.183***	91.030***	91.195***
	[32.35]	[32.35]	[32.35]	[32.35]	[32.35]	[32.35]	[32.35]	[32.35]	[32.35]	[32.35]	[32.24]	[32.35]	[32.16]	[32.24]
Number of Observations	684	684	684	684	684	684	684	684	684	684	683	684	680	681
Number of Districts	12	12	12	12	12	12	12	12	12	12	12	12	12	12

Absolute value of z statistics in brackets ** significant at 10%; ** significant at 5%; *** significant at 1%*

Table 5.8: *First stage regressions, 1991–2003, 171 communities, dependent variable: land price*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Income class, Swiss Franks p.a.	*0*	*0-9,999*	*10-19,999*	*20-29,999*	*30-39,999*	*40-49,999*	*50-59,999*	*60-69,999*	*70-79,999*	*80-89,999*	*90-99,999*	*100-149,999*	*150-199,999*	*¿200,000*
Left wing vote share	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	[0.92]	[0.92]	[0.92]	[0.92]	[0.92]	[0.92]	[0.92]	[0.92]	[0.92]	[0.92]	[0.94]	[0.92]	[0.94]	[0.78]
Lake Zurich	0.320***	0.320***	0.320***	0.320***	0.320***	0.320***	0.320***	0.320***	0.320***	0.320***	0.320***	0.320***	0.317***	0.321***
	[6.26]	[6.26]	[6.26]	[6.26]	[6.26]	[6.26]	[6.26]	[6.26]	[6.26]	[6.26]	[6.27]	[6.26]	[6.17]	[6.30]
Distance to Zurich	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
	[6.61]	[6.61]	[6.61]	[6.61]	[6.61]	[6.61]	[6.61]	[6.61]	[6.61]	[6.61]	[6.62]	[6.61]	[6.61]	[6.73]
Lake Greifensee	-0.251***	-0.251***	-0.251***	-0.251***	-0.251***	-0.251***	-0.251***	-0.251***	-0.251***	-0.251***	-0.251***	-0.251***	-0.249***	-0.253***
	[3.56]	[3.56]	[3.56]	[3.56]	[3.56]	[3.56]	[3.56]	[3.56]	[3.56]	[3.56]	[3.56]	[3.56]	[3.51]	[3.60]
Train Station	0.033**	0.033**	0.033**	0.033**	0.033**	0.033**	0.033**	0.033**	0.033**	0.033**	0.033**	0.033**	0.034**	0.034**
	[2.15]	[2.15]	[2.15]	[2.15]	[2.15]	[2.15]	[2.15]	[2.15]	[2.15]	[2.15]	[2.15]	[2.15]	[2.18]	[2.17]
Constant	0.815***	0.815***	0.815***	0.815***	0.815***	0.815***	0.815***	0.815***	0.815***	0.815***	0.816***	0.815***	0.817***	0.812***
	[16.08]	[16.08]	[16.08]	[16.08]	[16.08]	[16.08]	[16.08]	[16.08]	[16.08]	[16.08]	[16.06]	[16.08]	[15.98]	[16.02]
Number of Observations	684	684	684	684	684	684	684	684	684	684	683	684	680	681
Number of Districts	12	12	12	12	12	12	12	12	12	12	12	12	12	12

Absolute value of z statistics in brackets ** significant at 10%; ** significant at 5%; *** significant at 1%*

Chapter 6

Do Competitively Acquired Funds Induce Universities to Increase Productivity?

Do Competitively Acquired Funds Induce Universities to Increase Productivity?[1]

6.1 Introduction

Universities and public research institutions are perceived as a central piece of the national innovation system. During the past years, political pressure to use research funding in a more economic manner has increased dramatically. Consequently, the measurement and evaluation of university productivity has become increasingly important in both the political and the academic sphere. Third party funding, i.e. funding acquired from public and private sources in a competitive way, is used as a proxy for research output and quality both in the academic literature[2] and in research policy. In the UK, public third party funds are distributed via the Research Assessment Exercise, a large-scale operation that assigns a quality value to each research department and distributes funds accordingly. Similarly, the Swiss National Science Foundation (SNSF) which distributes the largest part of public third-party funding in Switzerland, considers the acquisition of third-party funds a relevant indicator.

However, while the relevance of third-party funding for total research funding has increased and both politicians and academics consider third party funding as an important indicator for research productivity, there are few articles analyzing the impact of different sources of third-party funding on university productivity. Furthermore, both the theoretical and empirical findings are ambiguous, indicating that further research in this area is required to allow policy-makers to make evidence-based decisions (van der Ploeg and Veugelers, 2008).

This study attempts to shed some light on this relationship by analyzing the effect of different funding resources on the productivity of Swiss university and public research institution departments (henceforth denoted university departments). Unlike some of the previous literature, we do not analyze the effect of funding restrictions (see e.g. Mensah and Werner, 2003; Kempkes and Pohl,

[1] This chapter is based on Bolli and Somogyi (2009).

[2] See e.g. Cohn et al. (1989), Izadi et al. (2002) and Mensah and Werner (2003).

2008; Kuo and Ho, 2007). Instead, we use the distinction between third-party funding stemming from public and private donors to analyze the impact on the productivity of university departments directly. We use survey data from the year 2005 to estimate a system of production function equations, where the included outputs are the number of master degrees,[3] the number of scientific publications and the intensity of technology transfer. We examine the explanatory power of the share of funding stemming from private and public third-party sources for the productivity of natural science, mathematics, physics, medicine, and economics departments.

We add to the existing literature by including a measure for technology transfer in our analysis. By distinguishing between public and private third-party funding, our approach allows us to identify the differences between the two funding sources in the innovation stages of basic research and applied research, measured by scientific publications and technology transfer intensity. Using a simultaneous equations (3SLS) approach, we account for the possible endogeneity between the different outputs.

Furthermore, we address the problem of endogeneity between the ability to acquire third-party funding and productivity using three approaches. First, we analyze the impact of third-party funding for universities where reverse causality is not present separately, second, we exploit the variance within universities to account for unobserved heterogeneity and third, we implement an IV estimation instrumenting the share of private funds in third party funding. A further advantage of the study is that the use of data at the department level ensures the proximity to the decision making unit while comprising the whole university sector as opposed to a single university. Finally, we present the first estimates for the relationship between the funding structure and productivity in Switzerland.

We find a significant effect of both private and public third-party funds on productivity. The effects differ between the different outputs. Public and private third party funds have no effect on teaching productivity, meaning that

[3] In 2005, Swiss Universities awarded all students with a degree (licentiat) equivalent to an M.Sc. in the anglo-saxon system. Bachelor's degrees did not exist at the time and are hence not included in this study.

third party funds do not add to the teaching financed by the universities' basic funding. Considering the production of scientific publications, we find that both funding types have a significantly positive impact on productivity. These findings are robust to the inclusion of technology transfer as a third output into the estimated system. Private funds exert a significantly positive effect on technology transfer productivity, while there is no measurable impact of public funds.

Our results also reveal that productivity of each output type differs across institution types and scientific fields. For example, medical departments are less productive in teaching than the baseline category, engineering departments, but more productive in producing scientific publications. Universities of Applied Sciences are found to be more productive in teaching, and less productive in scientific publications than the baseline category, which are the Federal Institutes of Technology. Our results are robust to a battery of robustness checks.

The chapter is structured as follows: Section 6.2 discusses the theoretical framework and Section 6.3 summarizes the existing empirical evidence. Sections 6.4 and 6.5 describe the data and the methodology applied in the estimations. The estimation results are discussed in Section 6.6. Section 6.7 concludes.

6.2 Theoretical Framework

While the competitiveness of the grant application process per se might induce productivity gains, this chapter analyzes the distinction between public and private third party funds and the different effects of these funds on productivity.

The relationship between a researcher and the donor of third-party funds is typically modeled in a principal-agent framework (see e.g. Kivistö, 2005). The donor is the principal and the researcher is the agent. If the two have different utility functions, the principal faces a trade-off between monitoring and accepting diverging outcomes caused by information asymmetry and uncertainty. The relationship is further complicated by the presence of multiple principals with different utility functions, notably public and private donors, which will choose different levels of monitoring. The optimal level of monitoring chosen by the

principals depends on the innovation stage, i.e. whether we look at basic research or applied research. Hence, the effect of different sources of third-party funding depends on several interrelated aspects: the type of the donor (public or private), which defines the monitoring intensity chosen by the donor, the innovation stage and the different influence channels of monitoring on productivity. We will try to shed light on the workings of these different aspects in the following paragraphs of this section.

The monitoring intensity of private donors is expected to increase in the innovation stage (basic research vs. applied research) due to two reasons. First, the relevance of creative control increases with the innovation stage (Aghion et al., 2008b). Second, the monitoring costs are decreasing in the innovation stage as the absorptive capacity of private donors is geared towards applied research. This implies that we expect the monitoring intensity and consequently the impact of private third-party funding on research productivity to increase in the innovation stage. It is even possible that monitoring is not profitable for early stages of the innovation process, in which case no monitoring by private donors takes place at all. The choice of monitoring intensity by public donors, however, follows a different logic. In the short-run, politicians decide upon the monitoring intensity exogenously. In the long-run, politicians decide upon monitoring intensity endogenously as well. Presumably, the absorptive capacity of public donors is better for basic research and worse for applied research. Therefore the expected degree of monitoring of public donors increases less with the innovation stage than the monitoring intensity of private donors.

Third-party funding, either directly or through monitoring by donors, influences research productivity through three main channels. The *administration effect* and the *misallocation effect* decrease productivity, while *discipline effect* increases it.

The first channel concerns the administrative work that comes along with third party funding. The acquisition of external funds requires the investment of time and money. Furthermore the principal might require the researcher to enclose details about the work progress, thereby affecting productivity negatively due to the additional work caused by writing reports. We call this channel the *administration effect*.

The second channel is caused by information asymmetry and different utility functions between the donor and the researcher (see e.g. Kivistö, 2005). Because of the difference in the utility functions, the principal has an interest to control the agent's behavior by restricting the use of funds. This may cause behavioral distortions and a suboptimal outcome, as these restrictions are based on incomplete information of the principal and will therefore lead to misallocation of resources (see e.g. Schiller and Liefner, 2006). Hence, we call this channel the *misallocation effect*.

The third channel causes research productivity to increase. This channel is based on the same information asymmetry as the misallocation effect. The effect on research productivity is however positive, as restrictions on the use of funds also limit the possibilities of the researcher to pursue his own goals and to use funds in an inefficient way (see e.g. Niskanen, 1971, 1975). We call this effect the *discipline effect*.

The presence of multiple, adverse channels implies that even in a framework of binarily modeled monitoring decisions, the impact on the productivity of universities is ambiguous, implying that it remains an empirical issue. The theoretical relationship becomes even more convoluted if the intensity of monitoring is modeled continuously, i.e. if the donor does not only decide whether to monitor or not, but if he also chooses the intensity of monitoring.

The administration effect increases with monitoring intensity, i.e. with the amount of time the researcher devotes to reporting and justifying his behavior. The misallocation and discipline effects on the other hand decrease if monitoring intensity increases. As the researcher reports his behavior more accurately, the information asymmetry diminishes. Therefore resources can be allocated in a more optimal way, and the researcher's opportunities to pursue his goals decrease. This implies that the administration effect, which lowers productivity, is increasing in monitoring intensity, while the misallocation effect, which also lowers productivity, and the discipline effect, which increases productivity, both decrease the more intense monitoring is done.

A further modeling complication is the potential non-linearity of these effects. An example is that while the first draft of the research plan might actually increase productivity, reporting each step will be very unproductive for the

Table 6.1: *Summary of theoretical effects of public and private third party funding on research productivity.*

Effect of innovation stage	Adm., mis. and disc. effects on productivity	Effect of monitoring intensity on adm., mis. and disc. effects
$\frac{\partial monit._{private}}{\partial innov.stage} > \frac{\partial monit._{public}}{\partial innov.stage}$	$\frac{\partial productivity}{\partial adm.eff.} < 0$	$\frac{\partial adm.eff.}{\partial monit.} > 0$
$\frac{\partial mis.eff.}{\partial innov.stage} < 0$	$\frac{\partial productivity}{\partial mis.eff.} < 0$	$\frac{\partial mis.eff.}{\partial monit.} < 0$
$\frac{\partial monit._{private}}{\partial innov.stage} > 0$	$\frac{\partial productivity}{\partial disc.eff.} > 0$	$\frac{\partial disc.eff.}{\partial monit.} < 0$

researcher. The discipline effect will be largest in the beginning as the information asymmetry is diminished the strongest. As monitoring intensity increases further, the information asymmetry decreases more slowly and the utility functions of the donor and the researcher become more congruent. Furthermore the danger of crowding out intrinsic motivation becomes more relevant (see e.g. Frey, 1997, on the interplay between intrinsic and extrinsic motivation).

The relationship between the misallocation effect and monitoring intensity is even less clear as multiple reasons for nonlinearity exist. First, as mentioned above, the diminishing information asymmetry causes it to decrease. Second, the misallocation effect depends on the innovation stage as proposed by Aghion et al. (2008b). They develop a model in which the benefits of creative control are highlighted. Assuming that the main advantage of academia over the private research sector is the ability to experiment, they show that the optimal location of research depends on the innovation stage. The more advanced an idea is, the stronger are the benefits from developing it in the private sector and vice versa. This indicates that the relevance of who has creative control in the research process varies by innovation stage and so does the misallocation effect. Restraining the researcher is hence the more detrimental, the more basic the research project is. Third, the impact of the funder having creative control is nonlinear per se. The more detailed the research report needs to be, the more the monitoring process will have the character of ex-ante monitoring thereby decreasing the researcher's leeway more severely. The issue is further complicated by the fact that the degree of monitoring can be determined endogenously.

The three channels through which third-party funding might affect productivity are opposing and non-linear, and depend positively or negatively on monitoring intensity. Table 6.1 gives an overview of the opposing effects. Therefore theoretical predictions about the direction of the total effect of these three channels are ambiguous, implying that the net impact of public and private third-party funding on research productivity is an empirical issue. Furthermore, we assume that basic research is geared towards scientific publications, while applied research is more likely to lead to technology transfer. Hence, the net effect of private and public funding is expected to differ between different output types.

6.3 Literature Review

A number of recent papers study the effect of different third-party funding sources on research productivity or efficiency and the different channels described in the previous section. Many of these papers are outcomes of the discussion on New Public Management (NPM), which describes the trend to introduce new government schemes in public science systems, leading to a move from a system with large operative competencies of the government authorities and individual independence in research and teaching of the researchers towards a system of greater steering competencies on the side of the research institutions and the researchers, and stronger hierarchy within the research institutions, i.e. a system where university management has greater power over the researchers.[4] The discussion in this strand of the literature is centered around several dimensions of governance, e.g. direct government interference, managerial self-governance, academic self-governance and stakeholder guidance (following de Boer et al., 2007a,b).

An empirical study of the influence of these aspects on research efficiency in Germany is presented by Schubert (2009), who finds significant relationships between the introduction of NPM government schemes, proxied by the the perceived influence of the deans and presidents and the existence of personnel quo-

[4]See e.g. Leisyte and Kizniene (2006) and Schubert (2009) and the references cited therein.

tas, goal agreements, accounting schemes, research councils and regular evaluations, where all variables but accounting schemes, which decreases efficiency, exert a positive influence on research efficiency. Translated into our framework, Schubert (2009) finds evidence for the efficiency-lowering administration effect (accounting schemes) and the efficiency-enhancing discipline effect (goal agreements, evaluations).

Evidence on the relationship between research productivity and regulation of research institutions by the state is presented by Aghion et al. (2008a). They show macroeconomic evidence for the misallocation effect, in the sense that autonomy, and productivity are positively related. A research institution is considered autonomous, in this study, if it has legal status and can conclude contracts, and if its governing bodies can determine with a considerable degree of freedom the policies and practices needed to accomplish its mission. The findings of Aghion et al. (2008a) are hence in line with the NPM literature. In a related study, Aghion et al. (2009) find a significant positive impact of autonomy on the Shanghai university ranking (Liu and Cheng, 2005), suggesting that a decrease in the misallocation effect increases productivity. Similar evidence is presented by Kempkes and Pohl (2008), who examine the productivity of German universities and find that universities are more productive, the more independent they are, and Duh and Kuo (2006), who analyze a Taiwanese amendment that grants universities more autonomy and find that the effect increased productivity.

Financial autonomy is studied by Mensah and Werner (2003) and Kuo and Ho (2007). Mensah and Werner (2003) evaluate the impact of financial autonomy on the efficiency of universities, using the share of unrestricted assets as a measure for financial flexibility. Applying a stochastic frontier methodology, they find a positive correlation between restriction and efficiency. This finding is supported by Kuo and Ho (2007) who examine a change in the budget regime in Taiwan that has led to more flexibility of the utilization of private funds. They find a negative impact of the policy adoption on the efficiency of universities. A negative correlation between (financial) autonomy and efficiency can be interpreted as evidence for the discipline effect.

The influence of competition between research institutions and research productivity has been studied in a number of papers. Aghion et al. (2009) show that

competition for research funding increases the Shanghai university ranking of the research institution, which is evidence for the discipline effect. Similarly, Butler (2003) finds that introducing a competitive funding distribution scheme based on output counts has increased the share of Australia's publications listed in the Institute of Scientific Information (ISI) index despite declining resources, indicating the presence of a disciplining effect. She further presents evidence of the misallocation effect, as the quality of publications measured by the share of citations has stagnated in the same period. Similarly, Agasisti (2009) analyzes the relationship between competition and tertiary education in Italy, finding a positive effect on efficiency, and Abbott and Doucouliagos (2009) find that competition for overseas students increases university productivity in Australia.

Direct evidence on the accumulated effect points to a mild positive influence of third-party funding. Cherchye and Abeele (2005) find a positive correlation between the share of total third-party funding and research efficiency. However, Cherchye and Abeele (2005) also split third party funding into funds from scientific research grants and contract research funds, and find that the positive effect of total third party funding is driven by scientific research grants, while contract research funds exert a negative effect on research efficiency. Bonaccorsi et al. (2006) analyze the impact of private funding on efficiency and find a U-shaped correlation for Italian universities, for which private funding is of rather limited relevance though. Using data on individual researchers at Louis Pasteur University, Carayol and Matt (2006) distinguish between public and private third-party funding and find a small effect of public funds on individual productivity but not of private funds. Similarly, Robst (2000, 2001) shows that the share of tuition in the total budget has no effect on the productivity of the university system and individual institutions.

Jansen et al. (2007) and Schmoch and Schubert (2009) present evidence on the relation between third party funding and research efficiency in Germany, where the system of university financing is very similar to the Swiss one. The two related papers, which use the same data set, study the effect of third party funding on research efficiency in four different academic fields. Overall, both papers find an inverted U-shaped relation between third party funding and the total number (i.e., not the per-capita number) of academic publications in a re-

search group. This means that up to a certain point additional third-party funds increase the number of publications, while beyond this point (which varies among the academic fields), additional funds decrease the number of publications. They argue that this is due to the fact that the number of researchers increases with the third party funds acquired, which induces transaction costs and coordination problems which decrease productivity, ultimately leading to a negative total effect. Schmoch and Schubert (2009) additionally find that the effect does not only depend on the academic field, but also on the donor of the funds, and that these donor effects also vary between the different fields, with different functional forms. However, they do not distinguish between private and public financing as we do in this study, but look at public funds from the German Research Association and the German governments, while EU funds are grouped together with industry funds, and all other third party funds are put in a residual group. For example, they find that for nano-technology, the inverted U-shaped relationship holds for all sources of funds but for EU money, which exerts a negative effect throughout. For astrophysics however the picture is totally different, with an insignificant net effect caused by U-shaped and inverted U-shaped effects that cancel each other out.

6.4 Data

In Switzerland four types of public research institutes exist: cantonal universities, federal institutes of technology, universities of applied sciences and federal research institutions. Of the ten cantonal universities, only those in Lucerne (only social sciences and theology), Lugano (only social sciences and architecture) and St. Gallen (only economics, law and management) limit the range of covered disciplines, while the others offer a broad spectrum. The federal institutes of technology in Zurich and Lausanne focus on engineering, natural sciences, mathematics and physics. The universities of applied sciences have been pure teaching institutions until the mid nineties. Their mandate was broadened to include applied research in the disciplines they cover: Engineering, management, social work, pedagogy, health professions and fine arts. Besides

these three types of higher education institution, there are four governmental research institutions: the Swiss Federal Institute of Aquatic Science and Technology (EAWAG), the Research Institute for Material Sciences and Technology (EMPA), the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) and the Paul Scherrer Institute (PSI) which conducts research on energy technologies and elementary particles physics.

In 2005, KOF Swiss Economic Institute conducted a survey among Swiss university departments and public research institutions. The questionnaire was sent to the directors of the research institutions and the heads of university departments.[5] The sample covers only fields related to technology and science: Engineering, natural sciences, mathematics, physics, medicine, economics and business administration. 241 of the 630 questionnaires were returned, implying a response rate of 38.3%. As not all of the respondents have answered all questions, our analysis includes a maximum of 187 observations. The response rate varies substantially between the types of institutions (see Table 6.9 in Section 6.8 for more details). As a consequence, the cantonal universities are underrepresented, while federal institutes and universities of applied sciences are overrepresented.[6]

The data entails the number of master degrees measuring teaching output. Research output is quantified as the number of papers published in scientific journals. The survey further contains several questions concerning the relevance of various technology transfer channels. The respondents attribute a value between one and five to each channel, where one refers to 'not important' and five to 'extremely important'. The channels are divided into five groups: 'Informal contacts', 'Technical facilities', 'Training', 'Research collaboration' and 'Consulting'. The number of questions within each group ranges from two to nine. If the answers to the questions in the different groups were averaged afterwards to get one number measuring technology transfer, the different number of answers in each group would imply different weights between the groups. Therefore we construct our measure for technology transfer as the sum of the

[5]The questionnaire is available in German, French and English at `http://www.kof.ethz.ch/surveys/structural/panel/wissensaustausch_2005`.

[6]For more information concerning the data, see Arvanitis et al. (2008).

average relevance in each group.

Labor input is available by the categories 'Professor', 'Post doc', 'Graduate', 'Technical Staff' and 'Administrative Staff'. Due to multicollinearity problems, we aggregate professors, postdocs and graduates to 'Academic Staff' and technical staff and administrative staff to 'Administrative Staff' (Filippini and Lepori (2007) report similar problems). Furthermore, the data entails information about the share of labor devoted to the activities teaching, basic research and applied research.[7] We combine the information about labor inputs and labor activity shares to construct labor inputs by activity. Thereby, we assume that labor activity shares are the same across input classes, i.e. that all labor input categories devote the same share of time for each activity.

Finally, the data includes information about financial resources of each department. Besides the overall budgets, the respondents disclose the share of third-party funds from governmental sources and from the business sector. We use this information to construct the two variables at the heart of this analysis. We denote third-party funds from the business sector divided by the total funds as '*BudgetSharePrivate*' and for third-party funds from governmental sources '*BudgetSharePublic*'. The latter mainly contains funds from the two Swiss research promotion agencies 'Swiss National Science Foundation' (SNSF) and 'Innovation Promotion Agency' (CTI). The remaining funds consist of the global budget of universities from various sources. Summary statistics are presented in Table 6.10 in Section 6.8.

In order to retain a substantial number of observations, we add 0.1 to all observations to eliminate observations taking the value 0. This procedure ensures that corner solutions are feasible despite the logarithmic production function specification. Thereby it allows university departments to specialize in the output mix. 180 of the total 241 observations have no missing values in the utilized variables.

[7] See question 28.

6.5 Methodology

In order to assess the effect of private and public third party funding on productivity, we regress the three output dimensions – master degrees, publications and technology transfer intensity – of the university departments on the share of private and public third party funding. To account for potential complementarities of the output dimensions, we employ three stage least squares (3SLS) estimations. In the first stage, 3SLS uses the predicted values resulting from a regression of each endogenous variable on all exogenous variables included in the system as instruments for all endogenous variables. In the second stage, the covariance matrix of the equation errors is estimated consistently using the residuals from the two stage least squares (2SLS) estimation of each equation. In the third stage, GLS estimation employing the covariance matrix estimated in the second stage and the instruments in place of the endogenous variables is performed.

The equations estimated take the following form

$$\begin{aligned} Output_i = \alpha + \beta_1 Public_i + \beta_2 Public_i^2 + \gamma_1 Private_i + \gamma_2 Private_i^2 \\ + \delta Labor_i + \xi X_i + \epsilon_i, \end{aligned} \tag{6.1}$$

where the dimension i refers to the analyzed department and bold variable names indicate vectors. $Output_i$ represents the respective output measure and $Public_i$ and $Private_i$ give the shares of public and private funds in third party funding. As we have argued above, the effects of third-party funding on research productivity may be non-linear. As some of the previous literature on research productivity and third party funding has indeed found U-shaped relationships, we do not only include linear terms of the variables of main interest, but also squared terms.

$Labor_i$ is a vector of labor inputs, containing the amount of labor input differentiated by 'Academics' (Acad), and 'Technical and Administrative Staff' (Other). We adjust total labor input by the share of work devoted to teaching, basic research and applied research in the equations for master degrees, publications and technology transfer, respectively. In order to account for complemen-

tarities between labor inputs, $Labor_i$ enters in the form of a translog function, i.e. entails quadratic terms of inputs as well as their interactions.

X_i is a vector of control variables that contains dummy variables for the following scientific fields: Natural Sciences, Medicine, Economics and Business, Mathematics and Physics. The base category is engineering. Furthermore, dummy variables for the institution types 'University', 'University of Applied Sciences' and 'Federal Research Institute' capture the differences to the base category 'ETH Swiss Federal Institute of Technology'. Finally, the vector of control variables includes the log of the total budget per employee to account for differences in the available budget. ϵ_i refers to the normally distributed error term with mean zero and variance σ_ϵ.

A problem to identify the effect of funding on productivity is that the quality of researchers might influence the ability to acquire third-party funding. Since our data set does not allow accounting for research quality directly, our estimates might suffer from an omitted variable bias. However, this drawback is not as substantial as it might seem. In our baseline setup, the direction of the bias, if it exists in our case, would be predictable (Robst, 2000). It is reasonable to assume that research quality and the acquisition of external funds are positively correlated. In this case, the true research output of departments with above average output quality would be underestimated. Consequently our estimates for the coefficient of third party funding would be underestimated, implying that the correlation between productivity and the share of external funds would be actually higher than our estimates show.

We use three alternative approaches to tackle the econometric problems of endogeneity due to omitted variable bias and reverse causality. However, as the survey was designed to capture technology transfer, only one of these approaches allows tackling endogeneity of public third-party funding, implying that a causal interpretation of our findings is more convincing for private funding.

The first approach separates departments based on a survey question whether technology transfer has increased research funding resources.[8] If this question

[8]See question 5.1 in the questionnaire `http://www.kof.ethz.ch/surveys/structural/panel/wissensaustausch_2005`.

is answered with yes, reverse causality and consequently endogeneity exists. We distinguish non-winners from winners, where we define winners as departments that have gained additional financial resources from technology transfer. We include two variables for private funding in our estimations, which capture the impact for non-winners ('Budget Share Public Non-Winners) and ('Budget share Private Non-Winners') and winners ('Budget Share Private Winners') separately. Concretely, we multiply private funding shares by a dummy for non-winners and winners, respectively. [9] This approach allows us to assess whether our results are solely driven by departments for which reverse causality is present.

Our second approach to tackle endogeneity in the estimation consists of exploiting within-university estimation by including university fixed effects, thereby controlling for unobserved heterogeneity, e.g. quality differences. This approach has the advantage that it accounts for unobserved heterogeneity for both public and private funding, while the other approaches only address problems related to private funding.

These two approaches are corroborated by a traditional instrumental variable (IV) approach, which solves the problems of measurement error in research output due to omitted quality, reverse causality and any remaining endogeneity bias (see e.g., Angrist and Krueger (1991) and Angrist and Krueger (2001)). We instrument the share of private funding by the answers to two questions concerning financial motives for engaging in technology transfer with private companies.[10]

We furthermore take into account the possibility that the effects of third party funding on productivity vary by academic field, as has been found by

[9] I.e., the first variable, 'Budget Share Private Non-Winners', gives the value of the share of third-party funding if the department has not gained additional financial means from technology transfer (non-winners) and zero, if the department has gained (winners), as well as a corresponding variable, 'Budget Share Private Winners', for winners, that gives the value of the share of third party funding if the department has gained additional financial means (winner) and zero, if the department has not gained additional funds from technology transfer.

[10] The research departments were asked to rank several financial motives to engage in technology transfer with private companies on a 1 (not important) to 5 (extremely important) scale. The options used as instruments here are 'resources for expanding basic research' and 'commercial success'. See question 4.1 in the questionnaire.

Schmoch and Schubert (2009). This may arise if the production technology varies by discipline. We tackle this issue by dropping individual disciplines from our sample in order to check if our results are driven by single disciplines. In addition, we drop medical departments and economics departments together, keeping a sample of only science fields.[11] We find that our results are robust to these variations in the sample.

Finally, we test whether our results are robust to the introduction of alternative measures of labor inputs in the regression specification. Specifically, we report specifications that do not adjust for the share of work devoted to a particular activity, implying that we include total labor inputs in all three output specifications. In addition, we allow all of the activity adjusted labor inputs to affect all outputs by including all of them in each equation.

6.6 Results

Table 6.2 displays the results of three stage least square estimations. Columns 1a-b and 2a-b show the results for the estimations including teaching and publications as output variables, while columns 3a-c and 4a-c also include technology transfer as a third output. The odd numbered columns contain linear estimations, while the even numbered columns also feature squared terms of the budget shares.

[11] Due to the small number of observations by field, regressions for single fields are not feasible.

Table 6.2: *Main Results*

Output	*Teaching*					*Publications*					*Technology Transfer*	
	(1a)	(2a)	(3a)	(4a)		(1b)	(2b)	(3b)	(4b)		(3c)	(4c)
Acad. Staff Teaching	0.591***	0.568***	0.591***	0.568***	*Acad. Staff Basic Research*	0.244***	0.242***	0.244***	0.241***	*Acad. Staff App. Res.*	0.046	0.045
	(0.094)	(0.094)	(0.094)	(0.094)		(0.078)	(0.080)	(0.078)	(0.079)		(0.029)	(0.029)
Admin. Staff Teaching	-0.051	-0.035	-0.052	-0.039	*Admin. Staff Basic Research*	0.209***	0.216***	0.208***	0.213***	*Admin. Staff App. Res.*	0.035	0.032
	(0.078)	(0.077)	(0.078)	(0.077)		(0.061)	(0.061)	(0.061)	(0.061)		(0.024)	(0.024)
Acad. Staff Teaching, sq.	0.110***	0.109***	0.111***	0.112***	*Acad. Staff Basic Res., sq.*	0.057	0.062	0.058	0.063	*Acad. Staff App. Res., sq.*	0.022**	0.021**
	(0.040)	(0.039)	(0.040)	(0.039)		(0.040)	(0.040)	(0.040)	(0.040)		(0.010)	(0.010)
Admin. Staff Teaching, sq.	-0.009	-0.008	-0.009	-0.008	*Admin. Staff Basic Res., sq.*	0.028***	0.029***	0.028***	0.028***	*Admin. Staff App. Res., sq.*	0.005*	0.005
	(0.008)	(0.008)	(0.008)	(0.008)		(0.007)	(0.007)	(0.007)	(0.007)		(0.003)	(0.003)
*Acad.*Admin. Teach.*	-0.077*	-0.077*	-0.078*	-0.080*	*Acad.*Admin. Basic. Res.*	-0.054	-0.060	-0.055	-0.061	*Acad.*Admin. App. Res.*	-0.025**	-0.022*
	(0.043)	(0.043)	(0.043)	(0.043)		(0.042)	(0.043)	(0.042)	(0.043)		(0.012)	(0.012)
Budget per employee	0.165	0.127	0.166	0.128	*Budget per employee*	0.302***	0.289***	0.303***	0.290***	*Budget per employee*	0.014	0.021
	(0.101)	(0.100)	(0.101)	(0.100)		(0.075)	(0.076)	(0.075)	(0.076)		(0.031)	(0.031)
Natural Science	-0.329	-0.348	-0.328	-0.346	*Natural Science*	0.265	0.260	0.265	0.260	*Natural Science*	-0.068	-0.084
	(0.294)	(0.291)	(0.294)	(0.291)		(0.216)	(0.216)	(0.216)	(0.216)		(0.091)	(0.091)
Medicine	-1.236***	-1.142***	-1.235***	-1.140***	*Medicine*	0.555**	0.585**	0.556**	0.587**	*Medicine*	-0.077	-0.096
	(0.316)	(0.313)	(0.316)	(0.313)		(0.238)	(0.238)	(0.238)	(0.238)		(0.096)	(0.096)
Economics and Business	0.701***	0.699***	0.700***	0.697***	*Economics and Business*	-0.229	-0.237	-0.230	-0.238	*Economics and Business*	-0.052	-0.043
	(0.252)	(0.249)	(0.252)	(0.249)		(0.182)	(0.182)	(0.182)	(0.182)		(0.077)	(0.077)
Math and Physics	-0.555*	-0.545	-0.555*	-0.545	*Math and Physics*	0.587**	0.572**	0.588**	0.573**	*Math and Physics*	-0.295***	-0.279***
	(0.336)	(0.333)	(0.336)	(0.333)		(0.260)	(0.263)	(0.260)	(0.263)		(0.104)	(0.104)
Univ. of App. Sci.	0.787***	0.792***	0.786***	0.792***	*Univ. of App. Sci.*	-1.651***	-1.617***	-1.652***	-1.617***	*Univ. of App. Sci.*	0.019	0.011
	(0.251)	(0.247)	(0.251)	(0.247)		(0.241)	(0.244)	(0.241)	(0.244)		(0.075)	(0.075)
University	0.066	0.065	0.066	0.067	*University*	-0.399**	-0.403**	-0.399**	-0.402**	*University*	0.035	0.049
	(0.253)	(0.250)	(0.253)	(0.250)		(0.186)	(0.187)	(0.186)	(0.187)		(0.077)	(0.077)
Federal Res. Inst.	0.205	0.162	0.206	0.164	*Federal Res. Inst.*	0.095	0.084	0.098	0.089	*Federal Res. Inst.*	-0.208	-0.185
	(0.404)	(0.397)	(0.404)	(0.397)		(0.301)	(0.300)	(0.301)	(0.300)		(0.128)	(0.127)
Budget share public	0.066	-0.154	0.066	-0.155	*Budget share public*	0.116**	0.043	0.116**	0.043	*Budget share public*	-0.013	0.023
	(0.076)	(0.112)	(0.076)	(0.112)		(0.054)	(0.082)	(0.054)	(0.082)		(0.022)	(0.034)
Budget share private	0.043	0.002	0.043	0.001	*Budget share private*	0.135***	0.128**	0.135***	0.128**	*Budget share private*	0.096***	0.090***
	(0.063)	(0.070)	(0.063)	(0.070)		(0.046)	(0.052)	(0.046)	(0.052)		(0.019)	(0.022)
Budget share public, sq.		-0.105**		-0.105**	*Budget share public, sq.*		-0.036		-0.037	*Budget share public, sq.*		0.020
		(0.041)		(0.041)			(0.031)		(0.031)			(0.013)
Budget share private, sq.		-0.025		-0.025	*Budget share private, sq.*		0.001		0.000	*Budget share private, sq.*		-0.012
		(0.041)		(0.041)			(0.031)		(0.031)			(0.012)
Constant	-1.985*	-1.445	-1.990*	-1.457	*Constant*	-3.330***	-3.159***	-3.336***	-3.166***	*Constant*	-0.203	-0.261
	(1.154)	(1.152)	(1.154)	(1.152)		(0.858)	(0.870)	(0.858)	(0.870)		(0.354)	(0.356)
Obs.	180	180	180	180		180	180	180	180		180	180
R-squared	0.51	0.52	0.51	0.52		0.72	0.72	0.72	0.72		0.42	0.43

*Columns 1a-b / 2a-b: Regressions excluding Technology Transfer, columns 3a-c / 4a-c: Regressions including technology transfer. Colums 1a-b / 3a-c: Linear terms of budget shares, columns 2a-b / 4a-c: Linear and quadratic terms of budget shares. ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.*

The production function estimations behave well in the sense that the coefficients of academic labor inputs are positive and significant with the exception of the technology transfer equation, where it is marginally insignificant.

Administrative and technical staff is found to be positively related to the production of academic publications, but not for teaching and technology transfer. The interaction term between Academic and Administrative and Technical staff reveals that an increase in the number of non-academic staff per academic employees reduces productivity in the fields of teaching and technology transfer, possibly because academics need to spend more time on coordinating the work of non-academic staff members. A larger budget per employee is found to increase productivity in respect to scientific publications. This coefficient might capture the fact that the price of labor inputs depends on its quality. Alternatively it might reflect gains from capital endowment.

The dummy variables for scientific fields reveal that medical departments are significantly less productive in teaching than engineering departments, which is our base category. The same holds for Math and Physics departments. The opposite is the case for the production of basic research, as measured by scientific publications. In this field, Medical Departments and Math and Physics departments outperform engineering departments. Economics and Business departments are found to be more productive in teaching. Finally, Math and Physics departments are found to be significantly less productive in technology transfer than engineering departments.

Universities of Applied Sciences, in line with their mission, are found to be more productive in teaching, and less productive in basic research than Federal Institutes of Technology. In the field of technology transfer, Universities of Applied Sciences do not differ significantly. The same is the case for the other types of research institutions in the field of technology transfer. Cantonal Universities are also found to be less productive in basic research than the Federal Institutes of Technology.

Turning to our variables of main interest, the shares of public and private third party funding, we find significant effects for both public and private funding. These effects vary between the different outputs, and remain largely unaffected by the inclusion of technology transfer intensity as a third output dimension.

We find no significant effect of private funding on teaching output, and a weak negative effect of public funding, as indicated by a negatively significant squared term. Private funding exerts a significantly positive effect on the production of scientific publications. The same holds for public third party funding. Private funding is positively related to technology transfer, while public funds have no significant effect in this respect. As private funds are often related to applied research projects, the interpretation of this finding is straightforward. The positive impact of public third-party funding on scientific publications is plausible since the Swiss research policy is geared towards the promotion of basic research, and hence the share of public funds mainly impact basic research production, which is more likely to result in publications than applied research. Quantitatively, one might suspect that the effect of public funds on publications is even larger than the estimated coefficient would suggest, as we might underestimate the correlation between third-party funds and productivity due to a possible endogeneity problem. The positive impact of private funding on basic research might be due to synergies between applied research and basic research. Furthermore, private funds for applied research might induce researchers to shift other funds that have been previously used for applied research to the production of basic research. Employing Wald tests for differences in the size of the effect of public and private third party funds on research output, we find that the (insignificant) coefficients in the regressions for teaching output are not significantly different from each other (columns 1a-4a). The same is the case for publication output (columns 1b-4b). In the regressions for technology transfer (columns 3c-4c), we find that the effect of private funds is significantly larger than the (insignificant) effect of public funds, supporting our above finding that private funds promote applied research.

6.6.1 Reverse Causality, Unobserved Heterogeneity and Endogeneity

To tackle the endogeneity problems discussed above, we employ three different approaches. First, we separate departments that have gained additional financial means through technology transfer from those that have not gained additional funds and include an interaction term between the private funding share and a dummy variable capturing whether conducting technology transfer has increased the available research funding. Comparing the coefficients of these two groups reveals the presence of reverse causality. Assuming that our estimates are unbiased, the two coefficients for winners and non-winners are the same, while a higher coefficient for winners indicates reverse causality. Second, we introduce institution fixed effects to control for unobserved heterogeneity at the university level, e.g. differences in research quality. Finally, we instrument the share of private funds using an IV approach.

Table 6.3 shows the results of the first (columns 1a-b and 2a-c) and the second (columns 3a-b and 4a-c) approach. For the first approach, the results for the control variables remain stable in general, except for effect of Math and Physics departments on teaching productivity, which is still negative, but now insignificant.

Concerning the effect of public funds, columns 1a-b reveal that public funds are not associated with larger productivity in basic research. Public funds are also insignificant, as before, in the fields of teaching and technology transfer. The effect of private funds, differentiated by winners and non-winners, are again found to exert significantly positive effects on both publications and technology transfer intensity. The effect is significant for both winners and non-winners, with a larger effect for non-winners, indicating no reverse causality.

Columns 3a-b and 4a-c of Table 6.3 show the results of the estimations controlling for unobserved heterogeneity by including university fixed effects, meaning that we exploit within-university variation to identify the effect of third-party funding shares. Our results from Table 6.2 are also robust to this variation of the setup.

Table 6.3: *Endogeneity I*

Output	*Teaching*					*Publications*					*Technology Transfer*	
	(1a)	*(2a)*	*(3a)*	*(4a)*		*(1b)*	*(2b)*	*(3b)*	*(4b)*		*(2c)*	*(4c)*
Acad. Staff Teaching	0.550***	0.549***	0.493***	0.492***	*Acad. Staff Basic Research*	0.289***	0.290***	0.240***	0.239***	*Acad. Staff App. Res.*	0.040*	0.036
	(0.106)	(0.106)	(0.091)	(0.091)		(0.088)	(0.088)	(0.074)	(0.074)		(0.023)	(0.030)
Admin. Staff Teaching	-0.061	-0.063	-0.059	-0.064	*Admin. Staff Basic Research*	0.169**	0.164**	0.247***	0.246***	*Admin. Staff App. Res.*	-0.005	0.055**
	(0.087)	(0.087)	(0.075)	(0.075)		(0.066)	(0.066)	(0.058)	(0.058)		(0.018)	(0.023)
Acad. Staff Teaching, sq.	0.075*	0.076*	0.092**	0.094**	*Acad. Staff Basic Res., sq.*	0.057	0.059	0.100***	0.101***	*Acad. Staff App. Res., sq.*	0.002	0.019*
	(0.046)	(0.046)	(0.038)	(0.038)		(0.044)	(0.044)	(0.038)	(0.038)		(0.010)	(0.010)
Admin. Staff Teaching, sq.	-0.005	-0.005	-0.008	-0.009	*Admin. Staff Basic Res., sq.*	0.024***	0.024***	0.030***	0.030***	*Admin. Staff App. Res., sq.*	-0.000	0.006**
	(0.010)	(0.010)	(0.008)	(0.008)		(0.007)	(0.007)	(0.006)	(0.006)		(0.002)	(0.003)
*Acad.*Admin. Teaching*	-0.047	-0.048	-0.070*	-0.072*	*Acad.*Admin. Basic Res.*	-0.050	-0.053	-0.102**	-0.102**	*Acad.*Admin. App. Res.*	0.001	-0.021*
	(0.049)	(0.049)	(0.042)	(0.042)		(0.047)	(0.046)	(0.041)	(0.041)		(0.012)	(0.011)
Budget per employee	0.186	0.187	0.200**	0.202**	*Budget per employee*	0.233***	0.235***	0.349***	0.350***	*Budget per employee*	0.006	0.016
	(0.114)	(0.114)	(0.096)	(0.096)		(0.081)	(0.081)	(0.071)	(0.071)		(0.025)	(0.030)
Natural Science	-0.222	-0.220	-0.156	-0.150	*Natural Science*	0.243	0.244	0.372*	0.372*	*Natural Science*	-0.061	-0.144
	(0.343)	(0.343)	(0.284)	(0.284)		(0.252)	(0.252)	(0.206)	(0.206)		(0.073)	(0.089)
Medicine	-1.115***	-1.113***	-1.115***	-1.110***	*Medicine*	0.500*	0.505**	0.730***	0.731***	*Medicine*	-0.012	-0.015
	(0.358)	(0.358)	(0.325)	(0.325)		(0.256)	(0.256)	(0.242)	(0.242)		(0.076)	(0.101)
Economics and Business	0.680**	0.677**	0.500*	0.494*	*Economics and Business*	-0.194	-0.196	-0.315*	-0.315*	*Economics and Business*	-0.088	-0.027
	(0.272)	(0.272)	(0.257)	(0.257)		(0.186)	(0.186)	(0.186)	(0.186)		(0.059)	(0.080)
Math and Physics	-0.507	-0.505	-0.513	-0.513	*Math and Physics*	0.654**	0.660**	0.669***	0.671***	*Math and Physics*	-0.081	-0.285***
	(0.456)	(0.456)	(0.319)	(0.319)		(0.326)	(0.326)	(0.246)	(0.246)		(0.097)	(0.102)
Univ. of App. Sci.	0.786***	0.785***			*Univ. of App. Sci.*	-1.545***	-1.554***			*Univ. of App. Sci.*	0.045	
	(0.274)	(0.274)				(0.263)	(0.262)				(0.058)	
University	-0.021	-0.020			*University*	-0.407*	-0.406*			*University*	0.012	
	(0.304)	(0.304)				(0.213)	(0.213)				(0.065)	
Federal Res. Inst.	0.161	0.163			*Federal Res. Inst.*	0.165	0.176			*Federal Res. Inst.*	-0.074	
	(0.468)	(0.468)				(0.336)	(0.336)				(0.104)	
Budget share public	0.057	0.056	0.137*	0.136*	*Budget share public*	0.063	0.062	0.152***	0.152***	*Budget share public*	-0.010	-0.015
	(0.087)	(0.087)	(0.073)	(0.073)		(0.059)	(0.059)	(0.053)	(0.053)		(0.018)	(0.022)
Budget share private, non-winners	-0.006	-0.007			*Budget share private, non-winners*	0.262***	0.263***			*Budget share private, non-winners*	0.118***	
	(0.131)	(0.131)				(0.091)	(0.091)				(0.028)	
Budget share private, winners	0.054	0.054			*Budget share private, winners*	0.110*	0.109*			*Budget share private, winners*	0.036**	
	(0.083)	(0.083)				(0.059)	(0.059)				(0.018)	
Budget share private			0.074	0.074	*Budget share private*			0.141***	0.141***	*Budget share private*		0.091***
			(0.060)	(0.060)				(0.044)	(0.044)			(0.019)
Constant	-2.224*	-2.230*	-2.343**	-2.368**	*Constant*	-2.514***	-2.532***	-3.871***	-3.879***	*Constant*	-0.027	-0.187
	(1.308)	(1.308)	(1.089)	(1.089)		(0.924)	(0.924)	(0.806)	(0.806)		(0.284)	(0.341)
Obs.	155	155	180	180	*Obs.*	155	155	180	180	*Obs.*	155	180
R-squared	0.476	0.476	0.590	0.590	*R-squared*	0.730	0.730	0.765	0.765	*R-squared*	0.215	0.492
Field FE	yes	yes	no	no	*Field FE*	yes	yes	no	no	*Field FE*	yes	no
Institution FE	no	no	yes	yes	*Institution FE*	no	no	yes	yes	*Institution FE*	no	yes

*Columns 1a-b / 2a-c: Regressions separating non-winers and winners (reverse causality) from Technology Transfer, columns 3a-b / 4a-c: Regressions including university fixed effects. Colums 1a-b / 3a-b: Excluding technology transfer, columns 2a-c / 4a-c: Including technology transfer. ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.*

The results of our third approach, the IV estimations are shown in Tables 6.4 (first stage) and 6.5 (second stage). We instrument the share of private funds in third party financial means with the answers to two questions on the financial motives for engaging in technology transfer with private companies. The share of public funds is not instrumented due to the lack of a suitable instrument. Departments were asked to rank several financial motives to engage in technology transfer with private companies on a Likert scale ranging from 1 (not important) to 5 (extremely important). The motives used as instruments here are 'resources for expanding basic research' and 'commercial success'.

The test statistics show that these are valid instruments, i.e. are significantly related to the share of private funding and the p-value of the over-identification test lies above 10%.[12] The instruments are however somewhat weak, with an F-statistic of 4.20 in the regressions excluding technology transfer and 4.38 in the regressions including technology transfer[13] Again, we estimate two setups that include and exclude technology transfer.

The results largely confirm those of the base estimation. Third party funds from both private and public sources do no affect teaching productivity. Furthermore, while the share of public third party funds has no impact on technology transfer productivity, private funding enhances productivity in this dimension. However, the results in respect to publication productivity deviate somewhat from the above findings. Specifically, while the share of public third party funding is significant in the specification excluding technology transfer (column 1b), it becomes marginally insignificant when technology transfer is accounted for (column 2b). Conversely, private funding is insignificant in column 1b, but turns significant once we include technology transfer. These findings are in line with our theoretical considerations as well as with Bolli and Somogyi (2009) who suggest that the impact of public third party funding is more pronounced for basic research, while private donors focus more on applied research and technology transfer.

[12]The p-values of the Sargan statistic for individual instrumental variable estimations in respect to master degrees, publications and technology transfer are given by 0.23, 0.21 and 0.81, respectively.

[13]Note however that the general rule of thumb that F should be larger than 10 (Staiger and Stock, 1997) only applies in models with only one instrument.

Table 6.4: *IV methodology, first stage*

	(1)	(2)
Acad. Staff Teaching	-0.437**	-1.022*
	(0.200)	(0.590)
Admin. Staff Teaching	0.321*	0.773
	(0.191)	(0.566)
Acad. Staff Teaching, sq.	-0.009	0.195
	(0.057)	(0.305)
Admin. Staff Teaching, sq.	0.020	0.171
	(0.066)	(0.295)
*Acad.*Admin. Teaching*	-0.022	-0.396
	(0.081)	(0.590)
Acad. Staff Basic Research	0.470**	0.304
	(0.226)	(0.235)
Admin. Staff Basic Research	-0.458**	-0.451**
	(0.209)	(0.222)
Acad. Staff Basic Res., sq.	-0.018	0.037
	(0.080)	(0.081)
Admin. Staff Basic Res., sq.	-0.045	-0.069
	(0.064)	(0.065)
*Acad.*Admin. Basic Res.*	0.066	0.013
	(0.114)	(0.114)
Acad. Staff App. Res.		0.825
		(0.525)
Admin. Staff App. Res.		-0.449
		(0.492)
Acad. Staff App. Res., sq.		-0.211
		(0.317)
Admin. Staff App. Res., sq.		-0.144
		(0.315)
*Acad.*Admin. App. Res.*		0.407
		(0.624)
Budget per employee	-0.235*	-0.182
	(0.124)	(0.124)
Natural Science	-0.753*	-0.437
	(0.400)	(0.396)
Medicine	-1.570***	-1.547***
	(0.394)	(0.388)
Economics and Business	0.092	0.192
	(0.316)	(0.313)
Math and Physics	-1.466***	-1.169**
	(0.516)	(0.509)
Univ. of App. Sci.	0.458	0.332
	(0.426)	(0.425)
University	0.646*	0.539
	(0.338)	(0.333)
Federal Res. Inst.	0.759	0.185
	(0.542)	(0.545)
Budget share public	0.111	0.116
	(0.099)	(0.096)
Instrument 1	0.305***	0.311***
	(0.081)	(0.078)
Instrument 2	0.182**	0.170**
	(0.085)	(0.082)
Constant	1.416	0.684
	(1.469)	(1.465)
Obs.	158	158
R-squared	0.39	0.47

*Column 1: Excluding Technology Transfer, Column 2: Including Technology Transfer. Instrument 1 is the TT motive intensity of "Acquisition basic research funds". Instrument 2 is the TT motive intensity of "Commercialization." ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.*

Table 6.5: *IV methodology, second stage*

Output	Teaching			Publications			Technology Transfer
	(1a)	(2a)		(1b)	(2b)		(2c)
Acad. Staff Teaching	0.562***	0.545***	*Acad. Staff Basic Research*	0.274***	0.241***	*Acad. Staff App. Res.*	0.021
	(0.104)	(0.106)		(0.092)	(0.090)		(0.024)
Admin. Staff Teaching	-0.058	-0.059	*Admin. Staff Basic Research*	0.190***	0.205***	*Admin. Staff App. Res.*	-0.001
	(0.087)	(0.088)		(0.069)	(0.068)		(0.019)
Acad. Staff Teaching, sq.	0.083*	0.083*	*Acad. Staff Basic Res., sq.*	0.066	0.067	*Acad. Staff App. Res., sq.*	-0.002
	(0.045)	(0.045)		(0.045)	(0.044)		(0.011)
Admin. Staff Teaching, sq.	-0.005	-0.003	*Admin. Staff Basic Res., sq.*	0.026***	0.030***	*Admin. Staff App. Res., sq.*	0.001
	(0.010)	(0.010)		(0.008)	(0.007)		(0.002)
*Acad.*Admin. Teaching*	-0.054	-0.056	*Acad.*Admin. Basic Res.*	-0.061	-0.067	*Acad.*Admin. App. Res.*	0.003
	(0.048)	(0.048)		(0.047)	(0.046)		(0.013)
Budget per employee	0.172	0.213*	*Budget per employee*	0.251***	0.308***	*Budget per employee*	0.045*
	(0.117)	(0.115)		(0.086)	(0.083)		(0.027)
Natural Science	-0.234	-0.088	*Natural Science*	0.201	0.392	*Natural Science*	-0.050
	(0.364)	(0.356)		(0.275)	(0.262)		(0.080)
Medicine	-1.063**	-0.803*	*Medicine*	0.338	0.678**	*Medicine*	0.070
	(0.459)	(0.421)		(0.335)	(0.301)		(0.096)
Economics and Business	0.696***	0.693**	*Economics and Business*	-0.234	-0.227	*Economics and Business*	-0.114*
	(0.269)	(0.275)		(0.192)	(0.191)		(0.063)
Math and Physics	-0.491	-0.218	*Math and Physics*	0.507	0.883**	*Math and Physics*	0.083
	(0.536)	(0.506)		(0.403)	(0.370)		(0.116)
Univ. of App. Sci.	0.793***	0.700**	*Univ. of App. Sci.*	-1.568***	-1.716***	*Univ. of App. Sci.*	0.010
	(0.285)	(0.284)		(0.270)	(0.262)		(0.065)
University	-0.018	-0.122	*University*	-0.398*	-0.538**	*University*	-0.005
	(0.319)	(0.315)		(0.233)	(0.223)		(0.071)
Federal Res. Inst.	0.176	0.116	*Federal Res. Inst.*	0.152	0.073	*Federal Res. Inst.*	-0.039
	(0.465)	(0.472)		(0.348)	(0.343)		(0.110)
Budget share public	0.057	0.033	*Budget share public*	0.109*	0.089	*Budget share public*	-0.020
	(0.086)	(0.087)		(0.061)	(0.060)		(0.019)
Budget share private	0.066	0.210	*Budget share private*	0.030	0.225**	*Budget share private*	0.126***
	(0.179)	(0.141)		(0.133)	(0.102)		(0.034)
Constant	-2.067	-2.567*	*Constant*	-2.707***	-3.387***	*Constant*	-0.497
	(1.344)	(1.322)		(0.996)	(0.952)		(0.308)
Obs.	158	158	*Obs.*	158	158	*Obs.*	158
R-squared	0.48	0.46	*R-squared*	0.71	0.72	*R-squared*	0.13

*Columns 1a-b: Excluding Technology Transfer, Columns 2a-c: Including Technology Transfer. Instrumented Variable: Budget share private. ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.*

6.6.2 Robustness

In order to evaluate the robustness of our results, we drop individual disciplines from our sample to exclude that our results are driven by single disciplines. The results are presented in Tables 6.6 and 6.7. In addition to dropping single fields, we drop medical departments and economics departments together (columns 6a-b / 6a-c in both tables), keeping a sample of only science fields. Table 6.6 reports the results for the regressions excluding technology transfer, while technology transfer is included in Table 6.7. We find that our results are generally robust to these variations in the sample, the only exception being that the coefficient of public funding in the regression for publication output turns marginally insignificant.

Table 6.6: *Dropping Individual Scientific Fields excluding TT*

Output	*Teaching*							*Publications*					
	(1a)	*(2a)*	*(3a)*	*(4a)*	*(5a)*	*(6a)*		*(1b)*	*(2b)*	*(3b)*	*(4b)*	*(5b)*	*(6b)*
Field dropped	*Econ.*	*Engin.*	*Math. and Phys.*	*Med.*	*Nat. Sci.*	*Econ. and Med.*		*Econ.*	*Engin.*	*Math. and Phys.*	*Med.*	*Nat. Sci.*	*Econ. and Med.*
Acad. Staff Teaching	0.623***	0.604***	0.585***	0.507***	0.526***	0.605***	*Acad. Staff Basic Research*	0.205**	0.211**	0.260***	0.332***	0.247***	0.289***
	(0.111)	(0.112)	(0.103)	(0.111)	(0.100)	(0.130)		(0.080)	(0.091)	(0.085)	(0.092)	(0.093)	(0.095)
Admin. Staff Teaching	-0.101	-0.075	-0.048	0.076	-0.063	0.018	*Admin. Staff Basic Research*	0.284***	0.191***	0.189***	0.139*	0.197***	0.232***
	(0.084)	(0.098)	(0.084)	(0.095)	(0.081)	(0.105)		(0.064)	(0.072)	(0.065)	(0.077)	(0.067)	(0.081)
Acad. Staff Teaching, sq.	0.065	0.105**	0.109***	0.118***	0.049	0.074	*Acad. Staff Basic Res., sq.*	0.089**	0.042	0.060	0.004	0.070	0.055
	(0.060)	(0.044)	(0.042)	(0.043)	(0.051)	(0.075)		(0.040)	(0.049)	(0.043)	(0.049)	(0.044)	(0.049)
Admin. Staff Teaching, sq.	-0.025**	-0.010	-0.009	0.002	0.001	-0.013	*Admin. Staff Basic Res., sq.*	0.028***	0.026***	0.027***	0.023***	0.035***	0.024***
	(0.011)	(0.010)	(0.009)	(0.009)	(0.010)	(0.013)		(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
*Acad.*Admin. Teaching*	-0.011	-0.074	-0.076*	-0.095**	-0.025	-0.026	*Acad.*Admin. Basic Res.*	-0.085**	-0.039	-0.056	0.012	-0.076	-0.042
	(0.068)	(0.049)	(0.045)	(0.048)	(0.051)	(0.086)		(0.043)	(0.053)	(0.045)	(0.054)	(0.048)	(0.054)
Budget per employee	0.109	0.178	0.150	0.145	0.235**	-0.016	*Budget per employee*	0.297***	0.266***	0.301***	0.329***	0.309***	0.284**
	(0.104)	(0.112)	(0.107)	(0.150)	(0.106)	(0.164)		(0.075)	(0.082)	(0.079)	(0.110)	(0.084)	(0.112)
Natural Science	-0.033	-2.648**	-0.317	-0.396	0.000	-0.173	*Natural Science*	0.319	-2.479**	0.278	0.241	0.000	0.313
	(0.314)	(1.326)	(0.312)	(0.294)	(0.000)	(0.316)		(0.216)	(0.984)	(0.227)	(0.213)	(0.000)	(0.209)
Medicine	-0.846**	-3.391***	-1.231***	0.000	-1.231***	0.000	*Medicine*	0.549**	-2.345**	0.594**	0.000	0.633**	0.000
	(0.355)	(1.269)	(0.342)	(0.000)	(0.328)	(0.000)		(0.254)	(0.945)	(0.255)	(0.000)	(0.266)	(0.000)
Economics and Business	0.000	-1.422	0.715***	0.736***	0.535**	0.000	*Economics and Business*	0.000	-3.064***	-0.227	-0.243	-0.213	0.000
	(0.000)	(1.317)	(0.267)	(0.253)	(0.256)	(0.000)		(0.000)	(0.972)	(0.191)	(0.179)	(0.194)	(0.000)
Math and Physics	-0.374	-2.629**	0.000	-0.687**	-0.455	-0.585	*Math and Physics*	0.666***	-2.283**	0.000	0.544**	0.615**	0.663**
	(0.351)	(1.313)	(0.000)	(0.343)	(0.339)	(0.370)		(0.257)	(0.979)	(0.000)	(0.263)	(0.286)	(0.260)
Univ. of App. Sci.	0.942***	0.524	0.780***	0.804***	0.767***	1.048***	*Univ. of App. Sci.*	-1.732***	-1.837***	-1.655***	-1.504***	-1.569***	-1.594***
	(0.287)	(0.410)	(0.269)	(0.259)	(0.253)	(0.304)		(0.253)	(0.404)	(0.252)	(0.253)	(0.267)	(0.265)
University	-0.254	0.198	0.034	0.141	0.083	-0.163	*University*	-0.403**	-0.459**	-0.426*	-0.365*	-0.435**	-0.403**
	(0.286)	(0.302)	(0.304)	(0.259)	(0.277)	(0.297)		(0.203)	(0.223)	(0.221)	(0.189)	(0.221)	(0.204)
Federal Res. Inst.	0.027	0.848*	0.182	0.143	-0.828	0.003	*Federal Res. Inst.*	0.063	-0.258	0.102	0.086	0.674	0.056
	(0.407)	(0.515)	(0.428)	(0.401)	(0.643)	(0.408)		(0.289)	(0.377)	(0.317)	(0.299)	(0.527)	(0.281)
Budget share public	0.047	0.044	0.065	0.026	0.054	0.043	*Budget share public*	0.136**	0.081	0.104*	0.154**	0.143**	0.179**
	(0.082)	(0.093)	(0.079)	(0.097)	(0.078)	(0.112)		(0.058)	(0.068)	(0.057)	(0.069)	(0.060)	(0.077)
Budget share private	0.045	0.100	0.037	-0.039	0.080	-0.055	*Budget share private*	0.174***	0.098*	0.135***	0.148***	0.127**	0.204***
	(0.071)	(0.073)	(0.067)	(0.075)	(0.065)	(0.093)		(0.051)	(0.054)	(0.049)	(0.054)	(0.051)	(0.064)
Constant	-1.351	0.000	-1.798	-1.779	-2.731**	0.031	*Constant*	-3.329***	0.000	-3.308***	-3.638***	-3.437***	-3.191**
	(1.188)	(0.000)	(1.218)	(1.701)	(1.209)	(1.865)		(0.855)	(0.000)	(0.900)	(1.244)	(0.955)	(1.265)
Obs.	147	117	162	141	153	108		147	117	162	141	153	108
R-squared	0.51	0.57	0.51	0.40	0.53	0.41		0.73	0.69	0.70	0.75	0.71	0.78

***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.

Table 6.7: *Dropping Individual Scientific Fields including TT*

Output			*Teaching*						*Publications*				
	(1a)	*(2a)*	*(3a)*	*(4a)*	*(5a)*	*(6a)*		*(1b)*	*(2b)*	*(3b)*	*(4b)*	*(5b)*	*(6b)*
Field dropped	*Econ.*	*Engin.*	*Math. / Phys.*	*Med.*	*Nat. Sci.*	*Econ. / Med.*		*Econ.*	*Engin.*	*Math. / Phys.*	*Med.*	*Nat. Sci.*	*Econ. / Med.*
Acad. Staff Teaching	0.624***	0.605***	0.585***	0.507***	0.526***	0.604***	*Acad. Staff Teaching*	0.205**	0.212**	0.259***	0.333***	0.249***	0.290***
	(0.111)	(0.112)	(0.103)	(0.111)	(0.100)	(0.130)		(0.080)	(0.091)	(0.085)	(0.092)	(0.093)	(0.095)
Admin. Staff Teaching	-0.102	-0.078	-0.049	0.077	-0.062	0.020	*Admin. Staff Teaching*	0.283***	0.192***	0.188***	0.135*	0.195***	0.224***
	(0.084)	(0.098)	(0.084)	(0.095)	(0.081)	(0.105)		(0.064)	(0.072)	(0.065)	(0.077)	(0.067)	(0.081)
Acad. Staff Teaching, sq.	0.065	0.106**	0.110***	0.117***	0.048	0.072	*Acad. Staff Teaching, sq.*	0.088**	0.042	0.060	0.007	0.072	0.056
	(0.060)	(0.044)	(0.042)	(0.043)	(0.051)	(0.075)		(0.040)	(0.049)	(0.042)	(0.049)	(0.044)	(0.048)
Admin. Staff Teaching, sq.	-0.025**	-0.010	-0.009	0.002	0.001	-0.013	*Admin. Staff Teaching, sq.*	0.027***	0.026***	0.026***	0.022***	0.035***	0.023***
	(0.011)	(0.010)	(0.009)	(0.009)	(0.010)	(0.013)		(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
*Acad.*Admin. Teaching*	-0.012	-0.076	-0.077*	-0.094**	-0.025	-0.023	*Acad.*Admin. Basic Res.*	-0.085**	-0.038	-0.056	0.009	-0.077	-0.043
	(0.068)	(0.049)	(0.045)	(0.048)	(0.051)	(0.086)		(0.043)	(0.053)	(0.045)	(0.054)	(0.048)	(0.054)
Budget per employee	0.109	0.178	0.150	0.145	0.235**	-0.018	*Budget per employee*	0.298***	0.266***	0.301***	0.333***	0.309***	0.289***
	(0.104)	(0.112)	(0.107)	(0.150)	(0.106)	(0.164)		(0.075)	(0.082)	(0.079)	(0.110)	(0.084)	(0.112)
Natural Science	-0.033	-0.015	-0.315	-0.397	0.000	-0.173	*Natural Science*	0.319	-2.476**	0.279	0.240	0.000	0.312
	(0.314)	(0.375)	(0.312)	(0.294)	(0.000)	(0.316)		(0.216)	(0.984)	(0.227)	(0.213)	(0.000)	(0.209)
Medicine	-0.846**	-0.759**	-1.230***	0.000	-1.231***	0.000	*Medicine*	0.549**	-2.341**	0.595**	0.000	0.635**	0.000
	(0.355)	(0.368)	(0.342)	(0.000)	(0.328)	(0.000)		(0.254)	(0.945)	(0.255)	(0.000)	(0.266)	(0.000)
Economics and Business	0.000	1.205***	0.713***	0.736***	0.535**	0.000	*Economics and Business*	0.000	-3.059***	-0.228	-0.246	-0.213	0.000
	(0.000)	(0.392)	(0.267)	(0.253)	(0.256)	(0.000)		(0.000)	(0.972)	(0.191)	(0.179)	(0.194)	(0.000)
Math and Physics	-0.374	0.000	0.000	-0.686**	-0.455	-0.583	*Math and Physics*	0.667***	-2.280**	0.000	0.542**	0.615**	0.664**
	(0.351)	(0.000)	(0.000)	(0.343)	(0.339)	(0.370)		(0.257)	(0.979)	(0.000)	(0.263)	(0.286)	(0.260)
Univ. of App. Sci.	0.941***	0.527	0.779***	0.805***	0.767***	1.050***	*Univ. of App. Sci.*	-1.733***	-1.836***	-1.657***	-1.510***	-1.567***	-1.601***
	(0.287)	(0.410)	(0.269)	(0.259)	(0.253)	(0.304)		(0.253)	(0.403)	(0.252)	(0.253)	(0.267)	(0.265)
University	-0.254	0.199	0.034	0.141	0.083	-0.165	*University*	-0.402**	-0.460**	-0.425*	-0.361*	-0.435**	-0.397*
	(0.286)	(0.302)	(0.304)	(0.259)	(0.277)	(0.297)		(0.203)	(0.223)	(0.221)	(0.189)	(0.221)	(0.204)
Federal Res. Inst.	0.028	0.847	0.183	0.142	-0.830	-0.001	*Federal Res. Inst.*	0.065	-0.257	0.105	0.098	0.687	0.069
	(0.407)	(0.515)	(0.428)	(0.401)	(0.643)	(0.408)		(0.289)	(0.377)	(0.317)	(0.299)	(0.527)	(0.281)
Budget share public	0.047	0.044	0.065	0.027	0.054	0.043	*Budget share public*	0.136**	0.081	0.104*	0.153**	0.143**	0.179**
	(0.082)	(0.093)	(0.079)	(0.097)	(0.078)	(0.112)		(0.058)	(0.068)	(0.057)	(0.069)	(0.060)	(0.077)
Budget share private	0.045	0.100	0.037	-0.039	0.080	-0.055	*Budget share private*	0.174***	0.098*	0.135***	0.147***	0.127**	0.204***
	(0.071)	(0.073)	(0.067)	(0.075)	(0.065)	(0.093)		(0.051)	(0.054)	(0.049)	(0.054)	(0.051)	(0.064)
Constant	-1.355	-2.633**	-1.805	-1.772	-2.729**	0.058	*Constant*	-3.333***	0.000	-3.313***	-3.675***	-3.441***	-3.240**
	(1.188)	(1.313)	(1.218)	(1.701)	(1.209)	(1.865)		(0.855)	(0.000)	(0.900)	(1.244)	(0.955)	(1.265)
Obs.	147	117	162	141	153	108	*Obs.*	147	117	162	141	153	108
R-squared	0.51	0.57	0.51	0.40	0.53	0.41	*R-squared*	0.73	0.69	0.70	0.75	0.71	0.78

***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.

Table 6.8: *Dropping Individual Scientific Fields including TT, continued*

	Technology Transfer					
	(1c)	*(2c)*	*(3c)*	*(4c)*	*(5c)*	*(6c)*
	Econ.	*Engin.*	*Math. / Phys.*	*Med.*	*Nat. Sci.*	*Econ. / Med.*
Acad. Staff App. Res.	0.034	0.048	0.052*	0.042	0.036	0.028
	(0.035)	(0.042)	(0.030)	(0.031)	(0.032)	(0.037)
Admin. Staff App. Res.	0.049*	0.040	0.021	0.042	0.028	0.060**
	(0.026)	(0.035)	(0.024)	(0.027)	(0.024)	(0.031)
Acad. Staff App. Res., sq.	0.021	0.028**	0.023**	0.027***	0.003	0.030*
	(0.016)	(0.011)	(0.010)	(0.010)	(0.017)	(0.017)
Admin. Staff App. Res., sq.	0.006	0.006*	0.004	0.006**	0.004	0.009*
	(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.005)
*Acad.*Admin. App. Res.*	-0.024	-0.031**	-0.024**	-0.030**	-0.005	-0.036
	(0.020)	(0.014)	(0.012)	(0.012)	(0.018)	(0.022)
Budget per employee	0.010	0.010	0.010	0.074*	-0.009	0.063
	(0.033)	(0.038)	(0.031)	(0.042)	(0.033)	(0.047)
Natural Science	-0.109	-0.204	-0.092	-0.078	0.000	-0.118
	(0.100)	(0.459)	(0.091)	(0.085)	(0.000)	(0.093)
Medicine	-0.147	-0.240	-0.100	0.000	-0.012	0.000
	(0.113)	(0.437)	(0.099)	(0.000)	(0.099)	(0.000)
Economics and Business	0.000	-0.250	-0.078	-0.050	-0.026	0.000
	(0.000)	(0.456)	(0.077)	(0.072)	(0.078)	(0.000)
Math and Physics	-0.300***	-0.438	0.000	-0.358***	-0.240**	-0.350***
	(0.113)	(0.455)	(0.000)	(0.101)	(0.104)	(0.111)
Univ. of App. Sci.	-0.022	0.111	0.040	-0.014	0.016	-0.058
	(0.090)	(0.138)	(0.077)	(0.072)	(0.076)	(0.086)
University	0.105	0.041	0.056	0.028	-0.039	0.092
	(0.091)	(0.103)	(0.089)	(0.074)	(0.084)	(0.088)
Federal Res. Inst.	-0.188	-0.286	-0.168	-0.221*	-0.065	-0.202
	(0.133)	(0.177)	(0.128)	(0.122)	(0.205)	(0.128)
Budget share public	-0.006	-0.017	-0.023	0.009	-0.022	0.024
	(0.025)	(0.031)	(0.022)	(0.027)	(0.023)	(0.033)
Budget share private	0.109***	0.103***	0.092***	0.083***	0.091***	0.099***
	(0.023)	(0.025)	(0.019)	(0.022)	(0.020)	(0.028)
Constant	-0.141	0.000	-0.156	-0.868*	0.085	-0.737
	(0.378)	(0.000)	(0.355)	(0.482)	(0.371)	(0.540)
Obs.	147.000	117.000	162.000	141.000	153.000	108.000
R-squared	0.45	0.41	0.30	0.48	0.45	0.53

***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.

In our final robustness check, we test the robustness of our results to the variation of the definition of labor input in order to take into account possible synergies between the fields. Table 6.12[14] repeats our basic specification, while Table 6.13 includes the total labor input in all regressions. Finally, Table 6.14 presents estimations including all separate labor input types simultaneously in all regressions. Our main findings are again robust to this variation in the setup.

6.7 Conclusions

The measurement and evaluation of university productivity has become increasingly important during the past years, both in the academic discussion and in research policy. Third party funding is frequently used as a proxy for research output and quality in both fields. However, while the relevance of third-party funding has increased both in the political sphere and the academic literature, there are few articles analyzing the impact of different sources of third-party funding on research productivity. Furthermore, both the theoretical and empirical findings are ambiguous, indicating that further research in this area is required to allow policymakers to make evidence-based decisions.

In this study, we have filled this gap and analyzed the effect of public and private third party funding on the productivity of Swiss research institutions. Furthermore, we have extended the literature by the inclusion of technology transfer, which both economists and politicians perceive the universities' third mission, as a third output in the analysis. The results suggest that both public and private third party funds exert a positive effect on basic research productivity. Furthermore, we have found that private third party funds significantly increase technology transfer productivity, while neither private nor public third party funds have an effect on teaching productivity.

Our results are robust to a battery of robustness checks. We tackle the issue of endogeneity using three different approaches and find that our results remain largely unaltered. We further introduce several alternative measures of labor input. Our results are also robust to this variation. We also vary the sample

[14]The tables are shown in Section 6.8.

and drop individual academic fields to check whether the results from one field drive our results. We find that this is not the case, and find the same when we drop economics and medicine departments, keeping only natural science departments in the sample.

The extension of our results to other countries depend on the similarities of the research system of the country in question with the Swiss system. The German and Austrian systems are very similar, concerning political responsibilities for research policy, the organization of universities and, most importantly, the process of distribution of (public) third party funds. Both Swiss public research funding organizations, CTI and the SNSF, use peer-review processes including international experts to monitor the funded research. The same is the case for the German 'Deutsche Forschungsgemeinschaft' (DFG) and the Austrian 'Fonds zur Förderung der wissenschaftlichen Forschung' (FWF). Presumably, this procedure promotes productivity more than a strict bureaucratic approach. Our results may therefore apply less to countries that organize research funding distribution and monitoring in a different way.

A limitation of this study is that while the categories public and private funds might capture quite heterogeneous funding sources, our data only allows the separation of these two broad categories. It is left to future research to delve deeper into the issue and analyze the impact of more accurately specified funding sources on the behavior of researchers.

The estimation of dynamic effects provides an additional direction of future research, as this study, due to the cross-sectional nature of the data, studies only static effects. Dynamic effects might arise, because if external funds flow to the most productive researchers, the less productive researchers will acquire less funding resources. This opens the possibility of selection, either through self-selection based on income or promotion decision by supervisors. This might have an impact on the average researcher quality and consequently on research productivity.

A further politically relevant topic not addressed in this study is that third-party funds might have effects on the behavior of researchers beyond the impact on productivity. Of particular relevance for politicians is the possibility that private third-party funding induces the researcher to devote more time and effort

to applied projects, thereby reducing the work devoted to basic research (see e.g. Florida and Cohen, 1999; Geuna, 2001; Schiller and Liefner, 2006; Banal-Estañol and Macho-Stadler, 2008). Finally, the present state of research does not identify the relevance of individual channels but only the aggregate correlation. Disentangling these effects might be a further interesting path of research.

6.8 Tables

Table 6.9: *Population, Data Sample and Response Rates by Department*

Institutions	Population	Sample	Response Rate (%)
ETH-Domain			
Swiss Federal Inst. of Technology Zurich	87	45	51.7
Swiss Federal Inst. of Technology Lausanne	31	12	38.7
Federal Research Institutes	11	11	100.0
Cantonal University of			
Basle	32	11	34.4
Berne	84	33	39.3
Fribourg	17	5	29.4
Geneva	46	15	32.6
Italian Switzerland	9	2	22.2
Lausanne	69	12	17.4
Neuchâtel	22	6	27.3
St. Gallen	21	8	38.1
Zurich	74	22	29.7
University of Applied Sciences of			
Berne	13	9	69.2
Central Switzerland	10	5	50.0
Eastern Switzerland	36	14	38.9
Italian Switzerland	7	2	28.6
Northwestern Switzerland	27	17	63.0
Western Switzerland	12	4	33.3
Zurich	22	8	36.4
Total	630	241	38.3

Table 6.10: *Summary Statistics of Variables*

Variable	*Variable Description*	*Obs.*	*Mean*	*Std. Dev.*	*Min.*	*Max.*
Output						
Publications*	Scientific Publications	187	-0.13	1.44	-3.69	3.22
Teaching*	Number of Master Degrees	187	-0.16	1.50	-3.00	3.40
Technology Transfer*	Form Intensity Weighted Technology Transfer	187	-0.12	0.41	-0.99	0.54
Input						
Acad. Staff Total*	Full-time Academic Staff Total	187	0.10	1.15	-2.48	3.32
Other Staff Total	Full-time Administrative and Technical Staff Total	187	0.11	1.96	-8.62	4.91
Acad. Staff Teaching*	Full-time Academic Staff Teaching	180	-0.30	2.31	-12.93	3.16
Other Staff Teaching	Full-time Administrative and Technical Staff Teaching	180	-0.18	2.74	-11.63	4.19
Acad. Staff Basic Research*	Full-time Academic Staff Basic Research	180	-2.70	5.77	-12.86	4.17
Other Staff Basic Research*	Full-time Administrative and Technical Staff Basic Research	180	-2.20	5.46	-11.43	6.01
Acad. Staff App. Res.*	Full-time Academic Staff Applied Research	180	-1.00	3.87	-13.12	3.83
Other Staff App. Res.*	Full-time Administrative and Technical Staff Applied Research	180	-0.90	3.99	-11.97	5.25
Budget per Employee*	Budget per Employee in Swss Franks	187	11.40	0.88	7.32	12.84
Scientific Field						
Engineering	Engineering (Dummy)	187	0.35	0.48	0.00	1.00
Natural Science	Natural Sciences (Dummy)	187	0.14	0.35	0.00	1.00
Medicine	Medicine (Dummy)	187	0.23	0.42	0.00	1.00
Economics and Business	Economics and Business (Dummy)	187	0.18	0.39	0.00	1.00
Math and Ohysics	Mathematics and Physics (Dummy)	187	0.10	0.30	0.00	1.00
University Types						
Fed. Inst. Tech	Federal Institute of Technology (Dummy)	187	0.26	0.44	0.00	1.00
Fed. Res. Inst	Federal Research Institute (Dummy)	187	0.05	0.23	0.00	1.00
Univ. of App. Sci.	University of Applied Sciences (Dummy)	187	0.24	0.43	0.00	1.00
University	Cantonal University (Dummy)	187	0.44	0.50	0.00	1.00
Budget Shares						
Budget Share Public*	Public Third-Party Funds/Total Funds in					
Budget Share Private*	Private Third-Party Funds/Total Funds in					
Instruments						
Winner	Dummy indicating whether TT has increased funding	161	0.81	0.39	0.00	1.00
Instrument 1	Financial Motive for TT: Basic Research	164	3.00	1.44	1.00	5.00
Instrument 2	Financial Motive for TT: Commercialisation	164	2.60	1.34	1.00	5.00

*logged values

Table 6.11: *Cross-Correlations among the Variables*

	Publications	*Teaching*	*Technology Transfer*	*Acad. Staff Total**	*Other Staff Total**	*Acad. Staff Teaching**	*Other Staff Teaching**
Publications	1						
Teaching	-0.0403	1					
Technology Transfer	-0.0339	0.2017*	1				
*Acad. Staff Total**	0.7030*	0.2561*	0.0782	1			
*Other Staff Total**	0.4331*	-0.012	0.1630*	0.5216*	1		
*Acad. Staff Teaching**	0.4215*	0.2848*	0.0131	0.6097*	0.2553*	1	
*Other Staff Teaching**	0.3391*	0.1571*	0.1141	0.4948*	0.7599*	0.7327*	1
*Acad. Staff Basic Research**	0.6390*	-0.1328	-0.1624*	0.4552*	0.2263*	0.2371*	0.1661*
*Other Staff Basic Research**	0.6226*	-0.1791*	-0.1313	0.4475*	0.4373*	0.2016*	0.3118*
*Acad. Staff App. Res.**	-0.0171	0.1618*	0.3934*	0.1448	0.1604*	0.0096	0.0643
*Other Staff App. Res.**	-0.0133	0.0943	0.3993*	0.1315	0.4937*	-0.0356	0.3134*
*Budget per Employee**	-0.0174	0.2389*	0.0801	0.0112	-0.0078	0.0054	0.0065
Budget Share Public	0.0915	0.0434	-0.0947	-0.0526	-0.1788*	-0.1359	-0.1881*
Budget Share Private	-0.2195*	0.2375*	0.4381*	-0.1366	-0.1422	-0.0976	-0.0822
*Budget Share Private Winner**	0.2123*	0.0959	0.3055*	0.1906*	0.0994	0.088	0.055
Instrument 1	0.3181*	-0.0823	0.3320*	0.2766*	0.0703	0.1262	0.0528
Instrument 2	-0.1826*	0.2405*	0.3817*	-0.0242	-0.0506	-0.0184	0.0182

	*Acad. Staff Basic Research**	*Other Staff Basic Research**	*Acad. Staff App. Res.**	*Other Staff App. Res.**	*Budget per Employee**	*Budget Share Public**	*Budget Share Private**
*Acad. Staff Basic Research**	1						
*Other Staff Basic Research**	0.9547*	1					
*Acad. Staff App. Res.**	-0.1447	-0.1191	1				
*Other Staff App. Res.**	-0.1419	-0.0066	0.8996*	1			
*Budget per Employee**	-0.1453	-0.1284	0.2092*	0.1935*	1		
*Budget Share Public**	0.0478	-0.0101	-0.1402	-0.1772*	-0.2221*	1	
Budget Share Private	-0.2580*	-0.2619*	0.144	0.1234	-0.0549	0.091	1
Budget Share Private Winner	0.1109	0.1052	0.0968	0.0635	0.0788	-0.0061	0.2582*
Instrument 1	0.4219*	0.4054*	-0.0878	-0.1133	-0.1016	-0.0507	0.0966
Instrument 2	-0.2126*	-0.1810*	0.147	0.1556	0.1031	0.0449	0.2733*

	*Budget Share Private Winner**	*Instrument 1*	*Instrument 2*
*Budget Share Private Winner**	1		
Instrument 1	0.2218*	1	
Instrument 2	0.1172	0.0064	1

*logged values

Table 6.12: *Labor Input Variation, basic specification*

Output	*Teaching*			*Publications*			*Tech. Transfer*
	(1a)	*(2a)*		*(1b)*	*(2b)*		*(2c)*
Acad. Staff Teaching	0.591***	0.591***	*Acad. Staff Basic Research*	0.244***	0.244***	*Acad. Staff App. Res.*	0.046
	(0.094)	(0.094)		(0.078)	(0.078)		(0.029)
Admin. Staff Teaching	-0.051	-0.052	*Admin. Staff Basic Research*	0.209***	0.208***	*Admin. Staff App. Res.*	0.035
	(0.078)	(0.078)		(0.061)	(0.061)		(0.024)
Acad. Staff Teaching, sq.	0.110***	0.111***	*Acad. Staff Basic Res., sq.*	0.057	0.058	*Acad. Staff App. Res., sq.*	0.022**
	(0.040)	(0.040)		(0.040)	(0.040)		(0.010)
Admin. Staff Teaching, sq.	-0.009	-0.009	*Admin. Staff Basic Res., sq.*	0.028***	0.028***	*Admin. Staff App. Res., sq.*	0.005*
	(0.008)	(0.008)		(0.007)	(0.007)		(0.003)
*Acad.*Admin. Teaching*	-0.077*	-0.078*	*Acad.*Admin. Basic Res.*	-0.054	-0.055	*Acad.*Admin. App. Res.*	-0.025**
	(0.043)	(0.043)		(0.042)	(0.042)		(0.012)
Budget per employee	0.165	0.166	*Budget per employee*	0.302***	0.303***	*Budget per employee*	0.014
	(0.101)	(0.101)		(0.075)	(0.075)		(0.031)
Natural Science	-0.329	-0.328	*Natural Science*	0.265	0.265	*Natural Science*	-0.068
	(0.294)	(0.294)		(0.216)	(0.216)		(0.091)
Medicine	-1.236***	-1.235***	*Medicine*	0.555**	0.556**	*Medicine*	-0.077
	(0.316)	(0.316)		(0.238)	(0.238)		(0.096)
Economics and Business	0.701***	0.700***	*Economics and Business*	-0.229	-0.230	*Economics and Business*	-0.052
	(0.252)	(0.252)		(0.182)	(0.182)		(0.077)
Math and Physics	-0.555*	-0.555*	*Math and Physics*	0.587**	0.588**	*Math and Physics*	-0.295***
	(0.336)	(0.336)		(0.260)	(0.260)		(0.104)
Univ. of App. Sci.	0.787***	0.786***	*Univ. of App. Sci.*	-1.651***	-1.652***	*Univ. of App. Sci.*	0.019
	(0.251)	(0.251)		(0.241)	(0.241)		(0.075)
University	0.066	0.066	*University*	-0.399**	-0.399**	*University*	0.035
	(0.253)	(0.253)		(0.186)	(0.186)		(0.077)
Federal Res. Inst.	0.205	0.206	*Federal Res. Inst.*	0.095	0.098	*Federal Res. Inst.*	-0.208
	(0.404)	(0.404)		(0.301)	(0.301)		(0.128)
Budget share public	0.066	0.066	*Budget share public*	0.116**	0.116**	*Budget share public*	-0.013
	(0.076)	(0.076)		(0.054)	(0.054)		(0.022)
Budget share private	0.043	0.043	*Budget share private*	0.135***	0.135***	*Budget share private*	0.096***
	(0.063)	(0.063)		(0.046)	(0.046)		(0.019)
Constant	-1.985*	-1.990*	*Constant*	-3.330***	-3.336***	*Constant*	-0.203
	(1.154)	(1.154)		(0.858)	(0.858)		(0.354)
Obs.	180	180	*Obs.*	180	180	*Obs.*	180
R-squared	0.51	0.51	*R-squared*	0.72	0.72	*R-squared*	0.42

*Columns 1a-b: Excluding Technology Transfer, Columns 2a-c: Including Technology Transfer. ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.*

Table 6.13: *Labor Input Variation, total labor input*

Output	*Teaching*			*Publications*			*Tech. Transfer*
	(1a)	*(2a)*		*(1b)*	*(2b)*		*(2c)*
Acad. Staff Total	0.795***	0.795***	*Acad. Staff Total*	0.361***	0.361***	*Acad. Staff Total*	0.020
	(0.098)	(0.098)		(0.066)	(0.066)		(0.031)
Admin. Staff Total	-0.060	-0.060	*Admin. Staff Total*	0.249***	0.249***	*Admin. Staff Total*	0.080***
	(0.074)	(0.074)		(0.050)	(0.050)		(0.024)
Acad. Staff Total, sq.	0.080	0.080	*Acad. Staff Total, sq.*	0.027	0.027	*Acad. Staff Total, sq.*	-0.001
	(0.066)	(0.066)		(0.045)	(0.045)		(0.021)
Admin. Staff Total, sq.	-0.007	-0.007	*Admin. Staff Total, sq.*	0.039***	0.039***	*Admin. Staff Total, sq.*	0.009**
	(0.012)	(0.012)		(0.008)	(0.008)		(0.004)
*Acad.*Admin. total*	-0.142***	-0.142***	*Acad.*Admin. total*	-0.027	-0.027	*Acad.*Admin. total*	-0.006
	(0.052)	(0.052)		(0.035)	(0.035)		(0.016)
Budget per employee	0.103	0.103	*Budget per employee*	0.272***	0.272***	*Budget per employee*	0.013
	(0.098)	(0.098)		(0.067)	(0.067)		(0.031)
Natural Science	-0.215	-0.215	*Natural Science*	0.321*	0.321*	*Natural Science*	-0.190**
	(0.286)	(0.286)		(0.194)	(0.194)		(0.091)
Medicine	-1.492***	-1.492***	*Medicine*	0.226	0.226	*Medicine*	-0.248***
	(0.299)	(0.299)		(0.203)	(0.203)		(0.096)
Economics and Business	0.713***	0.713***	*Economics and Business*	-0.117	-0.117	*Economics and Business*	-0.055
	(0.245)	(0.245)		(0.167)	(0.167)		(0.078)
Math and Physics	-0.673**	-0.673**	*Math and Physics*	0.717***	0.717***	*Math and Physics*	-0.456***
	(0.328)	(0.328)		(0.223)	(0.223)		(0.105)
Univ. of App. Sci.	1.126***	1.126***	*Univ. of App. Sci.*	-1.841***	-1.841***	*Univ. of App. Sci.*	0.027
	(0.258)	(0.258)		(0.175)	(0.175)		(0.082)
University	0.130	0.130	*University*	-0.316*	-0.316*	*University*	0.012
	(0.244)	(0.244)		(0.166)	(0.166)		(0.078)
Federal Res. Inst.	-0.076	-0.076	*Federal Res. Inst.*	-0.115	-0.115	*Federal Res. Inst.*	-0.175
	(0.408)	(0.408)		(0.277)	(0.277)		(0.130)
Budget share public	0.006	0.006	*Budget share public*	0.251***	0.251***	*Budget share public*	0.002
	(0.073)	(0.073)		(0.050)	(0.050)		(0.023)
Budget share private	-0.000	-0.000	*Budget share private*	0.082**	0.082**	*Budget share private*	0.089***
	(0.060)	(0.060)		(0.041)	(0.041)		(0.019)
Constant	-1.333	-1.333	*Constant*	-2.903***	-2.903***	*Constant*	-0.145
	(1.120)	(1.120)		(0.760)	(0.760)		(0.358)
Obs.	187	187	*Obs.*	187	187	*Obs.*	187
R-squared	0.53	0.53	*R-squared*	0.77	0.77	*R-squared*	0.37

*Columns 1a-b: Excluding Technology Transfer, Columns 2a-c: Including Technology Transfer. ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.*

Table 6.14: *Labor Input Variation, all separate labor inputs*

Output	*Teaching*			*Publications*			*Tech. Transfer*
	(1a)	*(2a)*		*(1b)*	*(2b)*		*(2c)*
Acad. Staff Teaching	0.549***	0.007	*Acad. Staff Basic Research*	0.160	0.171	*Acad. Staff App. Res.*	0.022
	(0.161)	(0.311)		(0.121)	(0.120)		(0.082)
Admin. Staff Teaching	0.036	0.441	*Admin. Staff Basic Research*	0.136	0.097	*Admin. Staff App. Res.*	-0.003
	(0.151)	(0.295)		(0.108)	(0.107)		(0.075)
Acad. Staff Teaching, sq.	0.074	-0.166	*Acad. Staff Basic Res., sq.*	0.062	0.081*	*Acad. Staff App. Res., sq.*	0.088***
	(0.046)	(0.121)		(0.041)	(0.043)		(0.034)
Admin. Staff Teaching, sq.	-0.014	-0.149*	*Admin. Staff Basic Res., sq.*	0.015	-0.028	*Admin. Staff App. Res., sq.*	0.038
	(0.016)	(0.088)		(0.012)	(0.027)		(0.038)
*Acad.*Admin. Teaching*	-0.031	0.342*	*Acad.*Admin. Basic Res.*	-0.061	-0.046	*Acad.*Admin. App. Res.*	-0.132*
	(0.052)	(0.199)		(0.045)	(0.055)		(0.069)
Acad. Staff Basic Research	0.068	0.088	*Acad. Staff Teaching*	0.154	-0.219	*Acad. Staff Teaching*	-0.005
	(0.176)	(0.176)		(0.110)	(0.213)		(0.091)
Admin. Staff Basic Research	-0.081	-0.116	*Admin. Staff Teaching*	0.158	0.434**	*Admin. Staff Teaching*	0.018
	(0.157)	(0.157)		(0.103)	(0.201)		(0.086)
Acad. Staff Basic Res., sq.	0.057	0.065	*Acad. Staff Teaching, sq.*	0.031	-0.073	*Acad. Staff Teaching, sq.*	-0.086**
	(0.059)	(0.063)		(0.032)	(0.082)		(0.035)
Admin. Staff Basic Res., sq.	0.008	-0.075*	*Admin. Staff Teaching, sq.*	0.021**	-0.049	*Admin. Staff Teaching, sq.*	-0.018
	(0.017)	(0.039)		(0.011)	(0.060)		(0.026)
*Acad.*Admin. Basic Res.*	-0.072	-0.010	*Acad.*Admin. Teaching*	-0.033	0.137	*Acad.*Admin. Teaching*	0.113*
	(0.066)	(0.080)		(0.036)	(0.136)		(0.058)
Acad. Staff App. Res.		0.540*	*Acad. Staff App. Res.*		0.406**	*Acad. Staff Basic Research*	0.000
		(0.279)			(0.191)		(0.051)
Admin. Staff App. Res.		-0.327	*Admin. Staff App. Res.*		-0.216	*Admin. Staff Basic Research*	0.054
		(0.257)			(0.175)		(0.046)
Acad. Staff App. Res., sq.		0.256**	*Acad. Staff App. Res., sq.*		0.110	*Acad. Staff Basic Res., sq.*	-0.005
		(0.115)			(0.079)		(0.018)
Admin. Staff App. Res., sq.		0.245*	*Admin. Staff App. Res., sq.*		0.124	*Admin. Staff Basic Res., sq.*	-0.005
		(0.131)			(0.090)		(0.011)
*Acad.*Admin. App. Res.*		-0.481**	*Acad.*Admin. App. Res.*		-0.214	*Acad.*Admin. Basic Res.*	0.014
		(0.235)			(0.161)		(0.023)
Budget per employee	0.164	0.153	*Budget per employee*	0.296***	0.289***	*Budget per employee*	0.001
	(0.101)	(0.101)		(0.069)	(0.069)		(0.029)
Natural Science	-0.318	-0.109	*Natural Science*	0.146	0.311	*Natural Science*	-0.123
	(0.302)	(0.305)		(0.207)	(0.209)		(0.089)
Medicine	-1.181***	-1.224***	*Medicine*	0.545**	0.504**	*Medicine*	-0.084
	(0.322)	(0.316)		(0.221)	(0.216)		(0.092)
Economics and Business	0.738***	0.798***	*Economics and Business*	-0.082	-0.011	*Economics and Business*	-0.075
	(0.252)	(0.249)		(0.173)	(0.170)		(0.073)
Math and Physics	-0.514	-0.380	*Math and Physics*	0.624***	0.677***	*Math and Physics*	-0.250**
	(0.353)	(0.351)		(0.242)	(0.240)		(0.103)
Univ. of App. Sci.	0.893***	0.932***	*Univ. of App. Sci.*	-1.633***	-1.625***	*Univ. of App. Sci.*	0.074
	(0.329)	(0.325)		(0.226)	(0.222)		(0.095)
University	0.021	0.061	*University*	-0.410**	-0.384**	*University*	0.020
	(0.254)	(0.252)		(0.174)	(0.172)		(0.074)
Federal Res. Inst.	0.274	-0.006	*Federal Res. Inst.*	0.287	0.020	*Federal Res. Inst.*	-0.151
	(0.409)	(0.421)		(0.280)	(0.287)		(0.123)
Budget share public	0.062	0.045	*Budget share public*	0.209***	0.200***	*Budget share public*	-0.019
	(0.078)	(0.077)		(0.054)	(0.053)		(0.023)
Budget share private	0.053	0.014	*Budget share private*	0.140***	0.105**	*Budget share private*	0.111***
	(0.063)	(0.063)		(0.043)	(0.043)		(0.018)
Constant	-1.969*	-1.991*	*Constant*	-3.238***	-3.266***	*Constant*	-0.066
	(1.156)	(1.151)		(0.793)	(0.786)		(0.336)
Obs.	180	180	*Obs.*	180	180	*Obs.*	180
R-squared	0.52	0.54	*R-squared*	0.76	0.77	*R-squared*	0.50

*Columns 1a-b: Excluding Technology Transfer, Columns 2a-c: Including Technology Transfer. ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels. Robust standard errors in parentheses.*

Bibliography

Abbott, M., Doucouliagos, C., 2009. Competition and efficiency: Overseas students and technical efficiency in Australian and New Zealand universities. Education Economics 17 (1), 31–57.

Adolph, C., 2004. The dilemma of discretion: Career ambitions and the politics of central banking. Ph.D. thesis, Harvard University.

Agasisti, T., 2009. Market forces and competition in university systems: Theoretical reflections and empirical evidence from Italy. International Review of Applied Economics 23, 463–483.

Aghion, P., Dewatripont, M., Hoxby, C. M., Mas-Colell, A., Sapir, A., 2008a. Higher Aspirations: An Agenda for Reforming European Universities. Bruegel Blueprints.

Aghion, P., Dewatripont, M., Stein, J. C., 2008b. Academic freedom, private-sector focus, and the process of innovation. Rand Journal of Economics 39, 617–635.

Aghion, P., Bolton, P., 1990. Government domestic debt and the risk of default: A political-economic model of the strategic role of debt. In: Press, C. U. (Ed.), Public Debt Management: Theory and History. R. Dornbusch and M. Draghi, Cambridge, pp. 315–344.

Aghion, P., Dewatripont, M., Hoxby, C. M., Mas-Colell, A., Sapir, A., 2009. The governance and performance of research universities: Evidence from Europe and the U.S. NBER Working Paper 14851, National Bureau of Economic Research.

Aidt, T., Veiga, F., Veiga, L., 2009. Election results and opportunistic policies: A new test of the rational political business cycle model. Cambridge Working Papers in Economics 0934, University of Cambridge.

Aidt, T. S., Gassebner, M., 2007. Do autocratic states trade less? Cambridge Working Papers in Economics 0742, University of Cambridge.

Alesina, A., 1987. Macroeconomic policy in a two-party system as a repeated game. Quarterly Journal of Economics 102 (3), 651–678.

Alesina, A., Argadna, S., Trebbi, F., 2006. Who adjusts and when? On the political economy of reforms. NBER Working Paper 12049, National Bureau of Economic Research.

Alesina, A., Cohen, G. D., Roubini, N., 1993. Electoral business cycle in industrial democracies. European Journal of Political Economy 9 (1), 1–23.

Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., Wacziarg, R., 2003. Fractionalization. Journal of Economic Growth 8, 155–194.

Alesina, A., Drazen, A., 1991. Why are stabilizations delayed? American Economic Review 81, 1170–1188.

Alesina, A., Hausmann, R., Hommes, R., Stein, E., 1999. Budget institutions and fiscal performance in Latin America. Journal of Development Economics 59 (2), 253–273.

Alesina, A., Tabellini, G., 1990. A positive theory of fiscal deficits and government debt in a democracy. Review of Economic Studies 57 (3), 403–414.

Allers, M., de Haan, J., Sterks, C., 2001. Partisan influence on the local tax burden in the Netherlands. Public Choice 106 (3-4), 351–63.

Alt, J. E., Shepsle, K. A., 1990. Perspectives on Positive Political Economy. Cambridge University Press, Cambridge.

Angrist, J. D., Krueger, A. B., 1991. Does compulsory school attendance affect schooling and earnings? The Quarterly Journal of Economics 106 (4), 979–1014.

Angrist, J. D., Krueger, A. B., 2001. Instrumental variables and the search for identification: From supply and demand to natural experiments. Journal of Economic Perspectives 15 (4), 69–85.

Anselin, L., 1988. Spatial Econometrics: Methods and Models. Kluwer Academic Publishers, Dordrecht.

Anselin, L., Bera, A., 1998. Spatial dependence in linear regression models with an introduction to spatial econometrics. In: Ullah, A., Giles, D. (Eds.), Handbook of Applied Economic Statistics. Marcel Dekker, New York, pp. 237–289.

Anselin, L., Bera, A. K., Florax, R., Yoon, M. J., 1996. Simple diagnostic tests for spatial dependence. Regional Science and Urban Economics 26 (1), 77–104.

Arellano, M., 2003. Panel Data Econometrics. Oxford University Press, Oxford.

Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies 58 (2), 277–97.

Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics 68 (1), 29–51.

Arrow, K., 1951. Social Choice and Individual Values, 2nd Edition. John Wiley & Sons, New York.

Arvanitis, S., Kubli, U., Woerter, M., 2008. University-industry knowledge and technology transfer in Switzerland: What university scientists think about co-operation with private enterprises. Research Policy 37 (10), 1865–1883.

Bakija, J., Slemrod, J., 2004. Do the rich flee from high state taxes? Evidence from federal estate tax returns. NBER Working Paper 10645, National Bureau of Economic Research.

Balassone, F., Francese, M., Zotteri, S., 2008. Cyclical asymmetry in fiscal variables. Temi di discussione (economic working papers), Bank of Italy, Economic Research Department.

Banal-Estañol, A., Macho-Stadler, I., 2008. Commercial incentives in academia. City University Economics Discussion Papers.

Banks, A. S., 1999. Cross national time-series data archive. Banner Software.

Barro, R. J., Gordon, D. B., 1983a. A positive theory of monetary policy in a natural rate model. Journal of Political Economy 91 (4), 589–610.

Barro, R. J., Gordon, D. B., 1983b. Rules, discretion and reputation in a model of monetary policy. Journal of Monetary Economics 12 (1), 101–121.

Beck, N., Katz, J., 1995. What to do (and not to do) with time-series cross-section data. American Political Science Review 89 (3), 634–647.

Beck, T., Clarke, G., Groff, A., Keefer, P., Walsh, P., 2001. New tools in comparative political economy: The database of political institutions. World Bank Economic Review 15 (1), 165–176.

Belke, A., Herz, B., Vogel, L., 2005. Structural reforms and the exchange rate regime: A panel analysis for the world versus OECD countries. IZA Discussion Paper 1798, IZA - Institute for the Study of Labor.

Besley, T., Pande, R., Rao, V., 2005. Political selection and the quality of government: Evidence from South India. CEPR Discussion Paper 5201, Centre for Economic Policy Research.

Bhagwati, J., Srinivasan, T. N., 1995. Trade and the environment: Does environmental diversity detract form the case for free trade? In: Bhagwati, J., Hudec, R. E. (Eds.), Fair Trade and Harmonization: Prerequisites for Free Trade? Cambridge: MIT Press, pp. 159–223.

Bjørnskov, C., 2005. Does political ideology affect economic growth? Public Choice 123, 133–146.

Bjørnskov, C., 2008. The growth-inequality association: Government ideology matters. Journal of Development Economics 87 (2), 300–308.

Blau, F. D., Kahn, L. M., 1996. International differences in male wage inequality: Institutions versus market forces. Journal of Political Economy 104 (4), 791–836.

Blundell, R., Bond, S., 1998. Conditions and moment restrictions in dynamic panel data models. Journal of Econometrics 87 (1), 115–143.

Bolli, T., Somogyi, F., 2009. Do competitively acquired funds induce public research institutions to behave efficiently? KOF Working Papers 09-242, KOF Swiss Economic Institute, ETH Zurich.

Bonaccorsi, A., Daraio, C., Simar, L., 2006. Advanced indicators of productivity of universities: An application of robust nonparametric methods to Italian data. Scientometrics 66(2), 389–410.

Boockmann, B., Dreher, A., 2003. The contribution of the IMF and the World Bank to economic freedom. European Journal of Political Economy 19 (3), 633–649.

Brender, A., Drazen, A., 2005. Political budget cycles in new versus established democracies. Journal of Monetary Economics 52 (7), 1271–1295.

Brender, A., Drazen, A., 2008. How do budget deficits and economic growth affect reelection prospects? Evidence from a large panel of countries. American Economic Review 98 (5), 2203–20.

Brown, D. K., 2000. International trade and core labour standards: A survey of the recent literature. OECD Labour Market and Social Policy Occasional Papers 43, OECD, Directorate for Employment, Labour and Social Affairs.

Browning, E., 1975. Why the social insurance budget is too large in a democracy. Economic Inquiry 13, 373–88.

Buchanan, J., Tullock, G., 1962. The Calculus of Consent, Logical Foundations of Constitutional Democracy. University of Michigan Press, Ann Arbor.

Buchanan, J., Wagner, R., 1977. Democracy in Deficit: The Political Legacy of Lord Keynes. Academic Press, New York.

Bundesamt für Statistik, 2009. Schweizerische Arbeitskräfteerhebung (SAKE). Bundesamt für Statistik, Neuchatel.

Busse, M., 2004. The determinants of core labour standards: The case of developing countries. Economics Letters 83 (2), 211–217.

Busse, M., Spielmann, C., 2006. Gender inequality and trade. Review of International Economics 14 (3), 362–379.

Butler, L., 2003. Explaining Australia's increased share of isi publications – the effects of a funding formula based on publication counts. Research Policy 32 (1), 143–155.

Butler, T., Robson, G., 2003. Plotting the middle classes: Gentrification and circuits of education in London. Housing Studies 18 (1), 5–28.

Campos, N., Giovannoni, F., 2007. Lobbying, corruption and political influence. Public Choice 131 (1), 1–21.

Carayol, N., Matt, M., 2006. Individual and collective determinants of academic scientists' productivity. Information Economics and Policy 18 (1), 55–72.

Chappell, H. W., McGregor, R. R., Vermilyea, T., 2004. Rule, consensus building, and the power of the chairman: Arthur Burns and the FOMC. The Journal of Money, Credit and Banking 36 (3), 407–422.

Chattopadhyay, R., Duflo, E., 2004. Women as policymakers: Evidence from a randomized policy experiment in India. Econometrica 72 (5), 1409–1443.

Cherchye, L., Abeele, P. V., 2005. On research efficiency: A micro-analysis of Dutch university research in economics and business management. Research Policy 34 (4), 495–516.

Cigno, A., Rosati, F. C., Guarcello, L., 2002. Does globalization increase child labor? World Development 30 (9), 1579–1589.

Coate, S., Morris, S., 1999. Policy persistence. American Economic Review 89 (5), 1327–1336.

Cohn, E., Rhine, S. L. W., Santos, M. C., 1989. Institutions of higher education as multi-product firms: Economies of scale and scope. The Review of Economics and Statistics 71 (2), 284–90.

Conway, K. S., Rork, J. C., 2008. Income tax preferences for the elderly. Public Finance Review 36 (5), 523–562.

Cukierman, A., Meltzer, A. H., 1989. A political theory of government debt and deficits in a neo-ricardian framework. American Economic Review 79 (4), 713–32.

Cukierman, A., Tommasi, M., 1998. When does it take a Nixon to go to China? American Economic Review 88 (1), 180–97.

Dawson, J., 2003. Causality in the freedom-growth relationship. European Journal of Political Economy 19, 479–495.

de Bartolome, C. A. M., Ross, S. L., 2003. Equilibria with local governments and commuting: Income sorting vs. income mixing. Journal of Urban Economics 54, 1–20.

de Bartolome, C. A. M., Ross, S. L., 2004. Who's in charge of the central city? The conflict between efficiency and equity in the design of a metropolitan area. Journal of Urban Economics 56 (3), 458–483.

de Boer, H. F., Enders, J., Leisyte, L., 2007a. Public sector reform in Dutch higher education: The international transformation of the university. Public Administration 85(1), 27–46.

de Boer, H. F., Enders, J., Schimank, U., 2007b. On the way towards new public management? The governance of university systems in England, the Netherlands, Austria, and Germany. In: Jansen, D. (Ed.), New Forms of Governance in Research Organizations - Disciplinary Approaches, Interfaces and Integration. Springer: Dordrecht, pp. 135–152.

de Haan, J., Lundström, S., Sturm, J.-E., 2006. Market oriented institutions and policies and economic growth: A critical survey. Journal of Economic Surveys 20 (2), 157–191.

de Haan, J., Sturm, J.-E., 1994. Political and institutional determinants of fiscal policy in the European Community. Public Choice 80, 157–172.

de Haan, J., Sturm, J.-E., 1997. Political and economic determinants of OECD budget deficits and government expenditures: A reinvestigation. European Journal of Political Economy 13 (4), 739–750.

de Haan, J., Sturm, J.-E., 2000. On the relationship between economic freedom and economic growth. European Journal of Political Economy 16, 215–241.

de Haan, J., Sturm, J.-E., 2003. Does more democracy lead to greater economic freedom? New evidence for developing countries. European Journal of Political Economy 19 (3), 547–563.

de Haan, J., Sturm, J.-E., Beekhuis, G., 1999. The weak government thesis: Some new evidence. Public Choice 101, 163–176.

Devarajan, S., Dollar, D., Holmgren, T. (Eds.), 2001. Aid and Reform in Africa. The World Bank, Washington, DC.

Dewit, G., Görg, H., Montagna, C., 2009. Should I stay or should I go? Foreign direct investment, employment protection and domestic anchorage. Review of World Economics (Weltwirtschaftliches Archiv) 145 (1), 93–110.

Drazen, A., 2000. Political Economy in Macroeconomics. Princeton University Press, Princeton.

Drazen, A., Easterly, W., 2001. Do crises induce reform? Simple empirical tests of conventional wisdom. Economics and Politics 13 (2), 129–157.

Drazen, A., Grilli, V., 1993. The benefit of crises for economic reforms. American Economic Review 83 (3), 598–607.

Dreher, A., 2004. The influence of IMF programs on the re-election of debtor governments. Economics & Politics 16 (1), 53–75.

Dreher, A., 2006. Does globalization affect growth? Evidence from a new index of globalization. Applied Economics 38 (10), 1091–1110.

Dreher, A., Gaston, N., 2005. Has globalisation really had no effect on unions? Kyklos 60, 165–186.

Dreher, A., Lamla, M., 2007. The impact of crises on the selection of leaders. An empirical analysis. Mimeo.

Dreher, A., Lamla, M. J., Lein, S. M., Somogyi, F., 2009. The impact of political leaders' profession and education on reforms. Journal of Comparative Economics 37 (1), 169–193.

Dreher, A., Rupprecht, S. M., 2007. IMF programs and reforms – inhibition or encouragement? Economics Letters 95, 320–326.

Dreher, Axel, B. H., Karb, V., 2006. Is there a causal link between currency and debt crises? International Journal of Finance and Economics 11 (4), 305–325.

Duflo, E., 2005. Why political reservations? Journal of the European Economic Association 3 (2-3), 668–678.

Duh, R., Kuo, J., 2006. Law and university efficiency: The amendment of the university law in Taiwan. In: Proceedings of the 2006 Joint Conference on Information Sciences.

Eichenberger, R., Stadelmann, D., 2009. Consequences of debt capitalization: Property ownership and debt/tax choice. CREMA Working Paper Series 2009-08, Center for Research in Economics, Management and the Arts (CREMA).

Ellickson, B., 1971. Jurisdictional fragmentation and residential choice. American Economic Review 61 (2), 334–339.

Epple, D., Filimon, R., Romer, T., 1993. Existence of voting and housing equilibrium in a system of communities with property taxes. Regional Science and Urban Economics 23, 585–610.

Epple, D., Romer, T., Sieg, H., 2001. Interjurisdictional sorting and majority rule: An empirical analysis. Econometrica 69, 1437–1465.

Epple, D., Sieg, H., 1999. Estimating equilibrium models of local jurisdictions. Journal of Political Economy 107, 645–68.

Feinberg, R. E., 2006. Presidential mandates and ministerial institutions: Summitry of the Americas, the Organization of American States (OAS) and the Inter-American Development Bank (IDB). Review of International Organizations 1 (1), 69–94.

Feld, L. P., 2000. Steuerwettbewerb und seine Auswirkungen auf Allokation und Distribution: Ein Überblick und eine empirische Analyse für die Schweiz. Mohr Siebeck, Tübingen.

Feld, L. P., Kirchgässner, G., 1997. Die Kapitalisierung von Steuern und öffentlichen Leistungen in den Mietzinsen: Eine empirische Überprüfung der Tiebout-Hypothese für die Schweiz. In: Schmid, H. (Ed.), Finanz- und Wirtschaftspolitik in Theorie und Praxis. Haupt, Bern, pp. 64–92.

Feld, L. P., Kirchgässner, G., 2001. Income tax competition at the state and local level in Switzerland. Regional Science and Urban Economics 31, 181–213.

Fernandez, R., Rodrik, D., 1991. Resistance to reform: Status quo bias in the presence of individual-specific uncertainty. American Economic Review 81 (5), 1146–1155.

Filippini, M., Lepori, B., 2007. Cost structure, economies of capacity utilization and scope in Swiss higher education institutions. In: Bonaccorsi, A., Daraia, C. (Eds.), Universities and Strategic Knowledge Creation. Specialisation and Performance in Europe. Edward Elgar, pp. 272–305.

Fischer, J. A., Somogyi, F., 2009. Globalization and protection of employment. KOF Working Papers 09-238, KOF Swiss Economic Institute, ETH Zurich.

Florida, R., Cohen, W., 1999. Engine or infrastructure? The university role in economic development. In: Branscomb, L., Kodama, F., Florida, R. (Eds.), Industrializing Knowledge: University-Industry Linkages in Japan and the United States. MIT Press, Cambridge, pp. 589–610.

Fortin, N. M., Lemieux, T., 1997. Institutional changes and rising wage inequality: Is there a linkage? Journal of Economic Perspectives 11 (2), 75–96.

Franco, A., Winqvist, K., 2002. At the margins of the labor market? Women and men in temporary jobs in Europe. Statistics in Focus 13.

Frank, R., Gilovich, T., Regan, D., 1993. Does studying economics inhibit cooperation? Journal of Economic Perspectives 7, 159–171.

Frank, R., Gilovich, T., Regan, D., 1996. Do economists make bad citizens? Journal of Economic Perspectives 10, 187–192.

Franzese, R. J., 2001. The positive political economy of public debt: An empirical examination of the OECD postwar experience. Mimeo, University of Michigan, Ann Arbor.

Freedom House, 2002. Freedom in the world country ratings. Tech. rep., Freedom House.

Frey, B., 1997. Not Just for the Money. An Economic Theory of Personal Motivation. Edward Elgar: Cheltenham.

Frey, B., Pommerehne, W., Gygi, B., 1993. Economics indoctrination or selection? Some empirical results. Journal of Economic Education 24, 271–281.

Frey, B. S., Meier, S., 2003. Are political economists selfish and indoctrinated? Evidence from a natural experiment. Economic Inquiry 41, 448–462.

Garrett, G., Lange, P., 1991. Political responses to interdependence: What's "left" for the left? International Organization 45 (4), 539–64.

Gemmell, N., Kneller, R., Sanz, I., 2008. Foreign investment, international trade and the size and structure of public expenditures. European Journal of Political Economy 24, 151–171.

Geuna, A., 2001. The changing rationale for European university research funding: Are there negative unintended consequences. Journal of Economic Issues 35, 607–632.

Göhlmann, S., Vaubel, R., 2007. The educational and professional background of central bankers and its effect on inflation – an empirical analysis. European Economic Review 51 (4), 925–42.

Goemans, H., Gleditsch, K. S., Chiozzo, G., 2009. Introducing archigos: A data set of political leaders. Journal of Peace Research 46 (2), 269–138.

Golden, M., 2000. Economic integration and industrial relations: Is increasing openness bad for labor? Working Paper 1.62, University of Berkeley, Center for German and European Studies.

Grilli, V., Masciandaro, D., Tabellini, G., Malinvaud, E., Pagano, M., 1991. Political and monetary institutions and public financial policies in the industrial countries. Economic Policy 6 (13), 342–392.

Gwartney, J., Lawson, R., 2004. Economic Freedom of the World: 2004 Annual Report. Vancouver: The Fraser Institute.

Heckelman, J. C., 2000. Consistent estimates of the impact of special interest groups on economic growth. Public Choice 104 (3-4), 319–27.

Heckelman, J. C., Knack, S., 2008. Foreign aid and market-liberalizing reform. Economica 75 (299), 524–548.

Heinemann, F., 2004. Explaining reform deadlocks. Applied Economics Quarterly 55, 9–26.

Henry, P. B., 2003. Capital account liberalization, the cost of capital, and economic growth. American Economic Review 93, 91–96.

Hercowitz, Z., Strawczynski, M., 2004. Cyclical ratcheting in government spending: Evidence from the OECD. The Review of Economics and Statistics 86 (1), 353–361.

Hibbs, D. A., 1977. Political parties and macroeconomic policy. The American Political Science Review 71 (4), 1467–1487.

Horgos, D., Zimmermann, K., 2009. Interest groups and economic performance: Some new evidence. Public Choice 138 (3), 301–315.

Hsieh, C.-T., 2000. Bargaining over reform. European Economic Review 44, 1659–1676.

ILO, 2009. Rules of the Game: A Brief Introduction to International Labour Standards (Revised edition 2009). International Labour Organization, Geneva.

Izadi, H., Johnes, G., Oskrochi, R., Crouchley, R., 2002. Stochastic frontier estimation of a CES cost function: The case of higher education in Britain. Economics of Education Review 21 (1), 63–71.

Jansen, D., Wald, A., Franke, K., Schmoch, U., Schubert, T., 2007. Third party research funding and performance in research: On the effects of institutional conditions on research performance of teams. Kölner Zeitschrift für Soziologie und Sozialpsychologie 59, 125–149.

Jones, B. F., Olken, B. A., 2005. Do leaders matter? National leadership and growth since World War II. Quarterly Journal of Economics 120, 835–864.

Judson, R. A., Owen, A. L., 1999. Estimating dynamic panel data models: a guide for macroeconomists. Economics Letters 65 (1), 9–15.

Kempkes, G., Pohl, C., 2008. The efficiency of German universities – some evidence from non-parametric and parametric methods. Applied Economics Online First.

Kilby, C., 2006. Donor influence in multilateral development banks: The case of the Asian Development Bank. Review of International Organizations 2 (1), 173–159.

Kivistö, J., 2005. The government-higher education institution relationship: Theoretical considerations from the perspective of agency theory. Tertiary Education and Management 11, 1–17.

Kotsogiannis, C., Schwager, R., 2006. On the incentives to experiment in federations. Journal of Urban Economics 60 (3), 484–497.

Krueger, A., 1996. Observations on international labor standards and trade. NBER Working Papers 5632, National Bureau of Economic Research.

Kucera, D., 2002. Core labour standards and foreign direct investment. International Labour Review 141, 3–36.

Kuo, H., Ho, Y., 2007. The cost efficiency impact of the university operation fund on public universities in Taiwan. Economics of Education Review 27, 603–612.

Kydland, F. E., Prescott, E. C., 1977. Rules rather than discretion: The inconsistency of optimal plans. Journal of Political Economy 85 (3), 473–91.

Lambertini, L., 2003. Are budget deficits used strategically? Boston College Working Papers in Economics 578, Boston College Department of Economics.

Lamo, A., Pérez, J. J., Schuknecht, L., 2008. Public and private sector wages, co-movement and causality. OECD Working Paper Series 963, OECD.

Leisyte, L., Kizniene, D., 2006. New public management in Lithuania's higher education. Higher Education Policy 19, 377–396.

Leventhal, T., Brooks-Gunn, J., 2003. Children and Youth in Neighborhood Contexts. Current Directions in Psychological Science 12 (1), 27–31.

Liu, N., Cheng, Y., 2005. The academic ranking of world universities. Higher Education in Europe 30, 127–136.

Mayer, W., Riezman, R. G., 1987. Endogenous choice of trade policy instruments. Journal of International Economics 23 (3-4), 377 – 381.

McMillan, J., 2004. Avoid hubris: And other lessons for reformers. Finance and Development 41, 34–37.

Megginson, W. L., Netter, J. M., 2001. From state to market: A survey of empirical studies on privatization. Journal of Economic Literature 39, 321–389.

Mensah, Y. M., Werner, R., 2003. Cost efficiency and financial flexibility in institutions of higher education. Journal of Accounting and Public Policy 22 (4), 293–323.

Mikosch, H., Somogyi, F., 2009. The impact of political leaders' profession and education public finance. Mimeo.

Nickell, S. J., 1981. Biases in dynamic models with fixed effects. Econometrica 49, 1417–1426.

Niskanen, W., 1971. Bureaucracy in representative government. Aldine-Atherton, New York.

Niskanen, W., 1975. Bureaucrats and politicians. Journal of Law and Economics 18(3), 617–643.

Nordhaus, W. D., 1975. The political business cycle. Review of Economic Studies 42, 69–90.

Oates, W. E., 1969. The effects of property taxes and local public spending on property values: An empirical study of tax capitalization and the Tiebout hypothesis. Journal of Political Economy 77 (6), 957–71.

Oates, W. E., 1972. Fiscal Federalism. Harcourt Brace Jovanovich, New York.

Oates, W. E., 1973. The effects of property taxes and local public spending on property values: A reply and yet further results. Journal of Political Economy 81 (4), 1004–08.

Oates, W. E., 1999. An essay on fiscal federalism. Journal of Economic Literature 37, 1120–1149.

Oates, W. E., 2006. The many faces of the Tiebout model. In: Fischel, W. A. (Ed.), The Tiebout Model at Fifty: Essays in Public Economics in Honor of Wallace Oates. Lincoln Institute of Land Policy, Cambridge, pp. 21–45.

OECD, 2000. International trade and core labour standards. Organisation for Economic Co-operation and Development, Paris.

OECD, 2004. OECD Employment Outlook 2004. Organisation for Economic Co-operation and Development, Paris.

OECD, 2009. Economic outlook: Annual and quarterly data. Organisation for Economic Co-operation and Development, Paris.

Olson, M., 1965. The Logic of Collective Action: Public Goods and the Theory of Groups. Harvard University Press, Cambridge.

Olson, M., 1982. The Rise and Decline of Nations: Economic Growth, Stagflation, and Social Rigidities. Yale University Press, New Haven.

Pande, R., 2003. Can mandated political representation increase policy influence for disadvantaged minorities? Theory and evidence from India. American Economic Review 93 (4), 1132–1151.

Persson, T., Svensson, L., 1989. Why a stubborn conservative would run a deficit: Policy with time-inconsistent preferences. Quarterly Journal of Economics 104, 325–45.

Persson, T., Tabellini, G., 2002. Political Economics: Explaining Economic Policy. MIT Press, Cambridge.

Persson, T., Tabellini, G., 2003. Do electoral cycles differ across political systems? Working papers, IGIER (Innocenzo Gasparini Institute for Economic Research), Bocconi University.

Pettersson-Lidbom, P., 2001. An empirical investigation of the strategic use of debt. Journal of Political Economy 3, 570–583.

Pollakowski, H. O., 1973. The effects of property taxes and local public spending on property values: A comment and further results. Journal of Political Economy 81 (4), 994–1003.

Rajan, R., 2004. Why are structural reforms so difficult? Finance and Development 41 (2), 56–57.

Ricciuti, R., 2004. Political fragmentation and fiscal outcomes. Public Choice 118, 365–388.

Robst, J., 2000. Do state appropriations influence cost effciency in public higher education? Applied Economic Letters 72(6), 715–719.

Robst, J., 2001. Cost efficiency in public higher education institutions. The Journal of Higher Education 72, 730–750.

Rogoff, K., 1990. Equilibrium political budget cycles. American Economic Review 80 (1), 21–36.

Rogoff, K., Sibert, A., 1988. Elections and macroeconomic policy cycles. Review of Economic Studies 55 (1), 1–16.

Roodman, D., 2005. Xtabond2: Stata module to extend xtabond dynamic panel data estimator.

Ross, S., Yinger, J., 1999. Sorting and voting: A review of the literature on urban public finance. In: Ceshire, P., Mills, E. S. (Eds.), Handbook of Regional and Urban Economics. Vol. 3. North-Holland, Amsterdam, pp. 2001–2060.

Roubini, N., Sachs, J. D., 1989. Political and economic determinants of budget deficits in the industrial democracies. European Economic Review 33, 903–938.

Rubinstein, A., 2006. A skeptic comment on the studies of economics. Economic Journal 116, 116.

Schaltegger, C. A., Frey, R. L., 2003. Finanzausgleich und Föderalismus: Zur Neugestaltung der föderalen Finanzbeziehungen am Beispiel der Schweiz. Perspektiven der Wirtschaftspolitik 2, 239–258.

Schaltegger, C. A., Somogyi, F., Sturm, J.-E., 2009. Tax competition and income sorting: Evidence from the zurich metropolitan area. KOF Working Papers 09-240, KOF Swiss Economic Institute, ETH Zurich.

Schiller, D., Liefner, I., 2006. Higher education funding reform and university-industry links in developing countries: The case of Thailand. Higher Education 54, 543–556.

Schmidheiny, K., 2002. Income stratification in multi-community models. VWI Discussion Paper 15-02, University of Bern.

Schmidheiny, K., 2006a. Income segregation and local progressive taxation: Empirical evidence from Switzerland. Journal of Public Economics 90, 429–458.

Schmidheiny, K., 2006b. Income segregation from local income taxation when households differ in both preferences and income. Regional Science and Urban Economics 36, 270–299.

Schmidheiny, K., Hodler, R., 2006. How fiscal decentralization flattens progressive taxes. Finanzarchiv/Public Finance Analysis 62 (2), 281–304.

Schmoch, U., Schubert, T., 2009. Sustainability of incentives for excellent research - the German case. Scientometrics 81(1), 195–218.

Schubert, T., 2009. Empirical observations on new public management to increase efficiency in public research – boon or bane? Research Policy 38, 1225–1234.

Schuknecht, L., 1996. Political business cycles and fiscal policies in developing countries. Kyklos 49 (2), 155–70.

Shelburne, R. C., 2001. An explanation of the international variation in the prevalence of child labour. The World Economy 24 (3), 359–378.

Shi, M., Svensson, J., 2006. Political budget cycles: Do they differ across countries and why? Journal of Public Economics 90 (8-9), 1367–1389.

Sinn, H.-W., 2001. Social dumping in the transformation process. NBER Working Papers 8364, National Bureau of Economic Research.

Spolaore, E., 1993. Macroeconomic policy, institutions and efficiency. Ph.D. thesis, Harvard University.

Spolaore, E., 2004. Adjustments in different government systems. Economics & Politics 16, 117–146.

Stadelmann, D., 2009. Which factors capitalize into house prices? A Bayesian averaging approach. CREMA Working Paper Series 2009-10, Center for Research in Economics, Management and the Arts (CREMA).

Stadelmann, D., Billon, S., 2010. Capitalization of fiscal variables and land scarcity. CREMA Working Paper Series 2010-03, Center for Research in Economics, Management and the Arts (CREMA).

Staiger, D., Stock, J. H., 1997. Instrumental variables regression with weak instruments. Econometrica 65 (3), 557–586.

Statistisches Amt des Kantons Zürich, 1993. Zürcher Staatssteuerstatistik 1991. Statistisches Amt des Kantons Zürich, Zürich.

Statistisches Amt des Kantons Zürich, 1997. Zürcher Staatssteuerstatistik 1995. Statistisches Amt des Kantons Zürich, Zürich.

Statistisches Amt des Kantons Zürich, 2001. Zürcher Staatssteuerstatistik 1999. Statistisches Amt des Kantons Zürich, Zürich.

Statistisches Amt des Kantons Zürich, 2005. Zürcher Staatssteuerstatistik 2003. Statistisches Amt des Kantons Zürich, Zürich.

Statistisches Amt des Kantons Zürich, 2009a. Bevölkerung und Soziales. Statistisches Amt des Kantons Zürich, Zürich.

Statistisches Amt des Kantons Zürich, 2009b. Gemeindesteuerstatistik. Statistisches Amt des Kantons Zürich, Zürich.

Statistisches Amt des Kantons Zürich, 2009c. Nationalratswahlen: Wähleranteile der wichtigsten Parteien. Statistisches Amt des Kantons Zürich, Zürich.

Statistisches Bundesamt, 2009. Niedrigeinkommen und Erwerbstätigkeit: Begleitmaterial zum Pressegespräch am 19. August 2009 in Frankfurt am Main.

Stein, A., 1980. The politics of linkage. Worlds Politics 33, 62–81.

Stern, R. M., 2003. Standards and trade agreements. Working Papers 496, Research Seminar in International Economics, University of Michigan.

Stull, W. J., Stull, J. C., 1991. Capitalization of local income taxes. Journal of Urban Economics 29 (2), 182–190.

Tabellini, G., 1991. The politics of intergenerational redistribution. Journal of Political Economy 99, 335–57.

Tabellini, G., 2000. A positive theory of social security. Scandinavian Journal of Economics 102 (3), 523–45.

Tabellini, G., Alesina, A., 1990. Voting on the budget deficit. American Economic Review 80, 37–49.

Tavares, J., 2004. Does right or left matter? Cabinets, credibility and fiscal adjustments. Journal of Public Economics 88 (12), 2447–2468.

Tiebout, C. M., 1956. A pure theory of local expenditures. Journal of Political Economy 64 (5), 416–424.

Torgler, B., 2007. Trust in international organizations: An empirical investigation focusing on the United Nations. Review of International Organizations 3 (1), 65–93.

van der Ploeg, F., Veugelers, R., 2008. Towards evidence-based reform of european universities. CESifo Economic Studies 54 (2), 99–120.

Velasco, A., 1998. A model of fiscal deficits and delayed fiscal reforms. In: Poterba, J., von Hagen, J. (Eds.), Fiscal Institutions and Fiscal Performance. Chicago: Chicago University Press.

Volkerink, B., de Haan, J., 2001. Fragmented government effects on fiscal policy: New evidence.

von Hagen, J., 1992. Budgeting procedures and fiscal performance in the European Communities. European Economy - Economic Papers, Commission of the EC, Directorate-General for Economic and Financial Affairs (DG ECFIN).

Wacziarg, R., Welch, K. H., 2008. Trade liberalization and growth: New evidence. World Bank Economic Review 22, 187–231.

Wagner, R., 1976. Revenue structure, fiscal illusion, and budgetary choice. Public Choice 25, 45–61.

Wallerstein, M., Western, B., 2000. Unions in decline: What has changed and why? Annual Review of Political Science 3, 355–77.

Washington, E., 2006. Female socialization: How daughters affect their legislator fathers' voting on women's issues. Tech. Rep. 11924, NBER Working Paper.

Westhoff, F., 1977. Existence of equilibria in economies with a local public good. Journal of Economic Theory 14, 84–112.

Wilson, B., Coates, D., Heckelman, J., 2010. Special-interest groups and growth. Public Choice.

Wilson, J. D., 1999. Theories of tax competition. National Tax Journal 53, 269–304.

Wilson, J. D., Wildasin, D. E., 2004. Capital tax competition: Bane or boon? Journal of Public Economics 88, 1065–1091.

Windmeijer, F., 2005. A finite sample correction for the variance of linear efficient two-step GMM estimators. Journal of Econometrics 126 (1), 25–51.

World Bank, 2005. The political economy of Gram Panchayats in South India: Results and policy conclusions from a research project. Tech. rep., World Bank, Washington DC.

World Bank, 2006. World Development Indicators. CD-ROM edition.

World Bank, 2009. World Development Indicators. CD-ROM edition.

Yinger, J., Bloom, H., Börsch-Supan, A., Ladd, H., 1988. Property Taxes and House Values: The Theory and Estimation of Intrajurisdictional Property Tax Capitalization. Academic Press, Boston.

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